1975 REDFIELD PROGRESS REPORTS

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progress report

Agricultural Experiment Station South Dakota State University, Brookings

Red-75-1

1974 Spring Wheat Breeding

By Robert W. Pylman, Jr., spring wheat breeder, and Kathleen Sellers, technical assistant, Plant Science Department.

Introduction

The spring wheat breeding effort has moved toward a position we believe will allow us to evaluate, in 1975, advanced generation germplasm which will be potentially worthy of release as varieties. The genetic base from which we are now selecting breeding material is quite broad as evidenced by the diversity of pedigrees of those lines which have performed well agronomically in 1974 yield tests.

Summary

The breeding program at Redfield included yield testing approximately 160 advanced lines under dryland conditions, several lines under irrigated conditions, screening and selecting over 400 different segregating populations, and observing three international screening nurseries involving durum wheat, hard red spring wheat, and winter wheat by spring wheat crosses.

Methods

The following table shows data for several varieties grown in the advanced line yield test. The plot was planted with a double disk opener press drill and harvested with a small combine. The plots were 4 feet wide by 25 feet long and replicated.

The previous crop was irrigated soybeans. Phosphate at a rate of 46 lbs. of P_2O_5 per acre was applied before tandem disking in the spring. The plots were planted on April 24th and harvested on August 5th. The wheat was not irrigated.

Results and Discussion

The semi-dwarf varieties again yielded above the taller varieties by a large economic margin.

Several experimental lines yielded equal to and above the check varieties in the plot. These lines will be tested for milling and baking characteristics this winter.

Variety	Test Wt.	Yield Bu/A	Ht.	Head Date
Prodax	56.5	46.95	32	6/21
Bounty 208	59.9	45.58	27	6/20
Olaf	58.0	44.79	30	6/22
W.S. 6	57.0	42.68	31	6/21
Era	60.5	42.32	32	6/26
Bonanza	58.2	41.65	28	6/21
Protor	58.5	41.36	31	6/19
W.S. 1809	58.8	41.15	28	6/19
Nordak	59.5	38.00	36	6/21
Sheridan	59.0	36.53	38	6/24
Ellar	57.5	35.82	37	6/22
Nowesta	58.5	34.72	36	6/21
Waldron	59.3	33.02	35	6/22
Polk	60.5	31.81	37	6/23

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Agricultural Experiment Station South Dakota State University, Brookings

Red-75-2

Grain Sorghum and Corn Performance Trials

By J. J. Bonnemann, assistant professor, Plant Science Department

Introduction

Corn and grain sorghum varieties must be grown under different environmental conditions if their performance ability is to be evaluated adequately. The trials conducted at Redfield were one of seven grain sorghum and eight corn locations around South Dakota in 1974.

The entries included in these trials are the choice of the participating companies. Only corn hybrids registered with the State Department of Agriculture for the year of the trial are eligible for entry. Some experimental and check varieties of each crop are also included by Agricultural Experiment Station (SDAES) plant breeders.

Discussion

The corn and grain sorghum performance trials were all seeded on May 29. The row spacing was 36 inches for all trials. All trials were drilled in rows using cone-planters mounted over flexi-planter units with double disc openers. Recommended herbicide and insecticide treatments were banded over the row at time of seeding. They were for grassy weed and corn rootworm control, respectively.

The irrigated field trials were on land that had been in navy beans in 1973 and received 180 pounds of actual nitrogen. No nitrogen was applied for 1974 as high nitrate levels were found in soil samples pulled in the spring of 1974. The field was disked in the fall and worked with a field cultivator just prior to seeding. The dryland corn field had been cropped with millet in 1973. Soil tests indicated high nitrate levels and no fertilizer was applied in 1974. The field was disked twice in the fall of 1973 and once in early May of 1974. A field cultivator was used just prior to seeding. This field was also rather lumpy at time of seeding but stands were better than expected. The grain sorghum stands were good even though the seedbed could have been more favorable.

The grain sorghum stands were about 70,000 plants per acre. The corn stands were above desired levels, 12,000, in the dryland trial but only about 3/4 of the desired levels, 18,000 and 22,000, in the irrigated trials. No significant differences were obtained from the two population levels.

The grain sorghum trial was hand harvested on September 27. The first frost (28°) had occurred on September 3 and the leaves were quite dry at harvest. Stalks were still quite green, however. The corn trials were harvested on October 24. The irrigated trials were good in spite of the adverse effects of the season. The supplemental water was very beneficial but even that could not overcome some of the damaging effects of long periods of hot weather and strong winds at the time of pollination. The dryland yields were good for some entries and very poor for others. Some hybrids that might possibly be adapted in the area in years of more favorable conditions yielded quite poorly. The severe stresses caused considerable variation in the trials.

No fertilizer was applied as soil tests indicated high nitrate levels in the soil prior to time of seeding. The corn was cultivated as needed. The irrigated corn trial received four applications of water totaling 16.3 inches. The grain sorghum received three applications totaling 12.3 inches. The water was applied between July 10 and August 12.

The results are presented for the 1974 trials only (Tables 1, 2 and 3). Additional information will be found in circulars from the South Dakota Agricultural Experiment Station.

OVER

Table 1. Grain Sorghum Performance Trial, 1974

Brand & Variety	Yield, lb/A	Test Wt. lb/B	% H_2O 9/17
Pride P500 A	6620	58	29.3
Northrup-King NK 129	6560	58	35.+
Northrup-King NK 180	6515	57	35.+
Warner W -561	6470	53	35.+
SDAES R 506	6315	57	35.+
ACCO R 920	6225	57	31.1
Northrup-King NK 233A	6220	59	35.+
Northrup-King NK 180A	5960	57	34.3
Pioneer 866	5925	55	35.+
Pioneer 8 90	5895	58	32.6
Funk's G-251	5840	60	32.7
Pride P550 BR	5810	58	35.+
DeKalb C-42A	5715	54	35.+
DeKalb B-35R	5640	55	35.+
ACCO R 1014	5535	55	35.+
Pioneer 894	5490	59	31.5
Funk's G-393	5490	57	35.+
Warner W-55	5350	54	35.+
SDAES RS 610	5315	54	35.+
SDAES SD 503	5070	56	34.8
Funk's G-399	4915	55	35.+
SDAES SD 106	4655	58	28.0
ACCO R 1019	4620	54	35.+
Funk's HW 3075 Ex	3715	49	35.+
Mean	5660		
LSD (.05)	1110		

Table 2. Irrigated Corn Performance Trial, 1974

Brand & Variety	Yield, B/A	Percent Moisture	% Stalk Lodged
Curry SC-142	108.3	23.6	0
Sokota SS-51	104.6	16.8	0
Fontanelle 400	103.0	24.2	0
Sokota SS-67	101.6	25.0	0
McCurdy MSX 44A	100.0	23.8	0
O's Gold SX 1100	98.0	22.7	0
Disco SX 16	97.7	23.6	0
Renk RK 44	96.9	23.0	0
McCurdy MSX 24	96.7	15.8	0
Trojan TXS 94	94.7	19.6	0
Pioneer 3780	93.3	18.0	0
Funk's G-4288	91.4	19.8	0
Pride R-221	91.4	16.4	0
Trojan TX 90	91.4	17.2	0
ACCO UC 2901	90.8	19.3	0
Payco SX 680	90.7	19.4	0
McCurdy MSP 101	89.9	17.2	1
Pride R-200A	89.8	19.4	0
Pride 4404	88.9	19.2	0
Pioneer 3596	88.8	17.5	1
Sokota TS-49	88.6	19.7	0
O's Gold SX 900	88.1	17.0	1
Payco SX 865	88.1	26.1	0
Renk RK 11AA	87.4	18.1	0
ACCO UC 1151	87.3	17.5	0
Sokota MS-59A	86.8	18.1	0
ACCO UC 1901	85.2	17.5	0
ACCO UC 3201	84.5	23.7	0
Funk's G-4321	84.3	23.6	0
ACCO UC 2301	83.7	17.9	1
Funk's G-4444	83.5	25.3	0
Disco SX 14	83.4	19.4	0
Pioneer 3785	81.8	16.8	0
McCurdy MSP 111B	81.7	18.4	0
Payco SX 775	80.8	18.4	0
McCurdy MSP 333	79.5	21.2	0
Renk RK 66	78.9	25.1	0
Trojan TXS 92	77.7	15.5	1
SDAES SD 250	76.8	18.2	0
Funk's G-4366	75.9	23.1	0
ACCO U 334	74.9	19.9	0
SDAES SD 200	74.6	16.7	0
Trojan TXS 85	72.3	15.8	0
Pride R-123	72.1	17.8	0
Pride R-290	71.9	19.1	0
Curry SC-145	68.4	25.4	0
Pioneer 3764	65.0	19.6	0
Fontanelle 580	48.7	46.7	0
Mean	85.8	25.2	0
Standard error	4.0		

Table 3. Dryland Corn Performance Trial, 1974

Brand & Variety	Yield B/A	Percent Moisture	% Stalk Lodged
Funk's G-4288	47.3	22.4	0
Pioneer 3785	46.2	16.5	0
ACCO UC 2301	43.7	18.5	0
Funk's G-4444	43.3	24.7	0
Pioneer 3965	43.2	16.1	0
Curtis A201	43.0	26.7	0
ACCO U 334	40.9	19.8	1
SDAES PP 198	40.5	15.1	17
SDAES PP 147	40.0	15.1	2
Sokota SS-67	39.9	27.3	0
Curry SC-145	39.6	29.8	0
Payco SX 680	39.6	16.9	0
Funk's G-4321	39.4	22.7	0
Pride 4404	38.8	19.6	0
SDAES PP 199	38.7	17.9	0
ACCO UC 1151	38.7	19.7	1
Pioneer 3816	38.6	18.0	0
Fontanelle 400	38.1	24.4	2
SDAES PP 171	37.2	14.0	1
SDAES SD 220	34.9	16.0	0
Curtis 459	34.9	29.4	3
SDAES PP 146	34.0	15.1	4
Curry SC-144	33.1	25.6	1
ACCO U 314	32.4	16.8	0
Trojan TXS 92	32.1	15.1	2
Pride R-221	32.0	17.7	0
ACCO U 324	31.7	17.3	0
Pride R-123	29.9	16.1	0
ACCO DC 147	29.8	20.1	0
Funk's G-4366	28.8	26.9	3
Pride R-290	28.7	21.9	1
Payco SX 775	28.6	19.8	0
SDAES SD 200	28.2	15.8	7
Disxo SX 9	28.0	16.2	1
SDAES SD 230	27.7	21.1	12
Pioneer 3932A	26.6	17.5	1
Trojan TXS 85	25.9	15.5	0
Sokota TS-46	25.8	18.8	0
Trojan TX 90	25.1	16.6	0
Curtis 521	25.1	22.4	0
SDAES SD 250	23.9	20.8	0
Payco 3X 783	22.9	22.5	0
Trojan TXS 94	22.3	16.8	0
Sokota MS-59A	19.9	21.1	16
Fontanelle 580	14.2	41.3	0
Mean	33.4	20.2	2
Standard error	5.9		

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Agricultural Experiment Station South Dakota State University, Brookings

Red-75-3

BEANS

By Paul Prashar, associate professor, Horticulture-Forestry Department

One of the goals of the South Dakota Agricultural Experiment Station is to seek out new crops which can be grown in the state or in a given region to increase the income of our farmers. Beans have shown a great potential in the last 3 years in the Redfield area. In 1972 and 1973, only pea beans were planted at the James Valley Research and Extension Center, and yields were very promising. In 1974, 11 varieties of beans were planted on May 23. Nine varieties were pea beans and two varieties were pinto beans. Pea beans generally yield less but the price per pound is higher; pinto beans yield more but the price per pound is lower.

The middle two rows of four rows were harvested on September 11. The yield data are listed in Table 1. The beans were furrow irrigated on July 19, August 1 and 14. It is difficult to draw any conclusive results from these data, because the seed of one variety provided to us by one of our main cooperators was not certified seed. The variety, Snowflake, spread bacterial blight to the other varieties early in the growing season and reduced their yield capabilities. Extra care should be taken in obtaining seed. It is essential that the grower obtain only certified seed for beans, or yield will be greatly reduced.

There was no insect problem on the beans, but bacterial blight was severe. None of the varieties was sprayed for disease or insects during the growing season.

Table 1. Dry Beans Variety Trial (under irrigation).

	Variety	Yield/acre lbs.
1.	Sanilac	1158
2.	Bonus	1209
3.	Aurora	1779
4.	Kentwood	1847
5.	W-5 (6R-395)	1437
6.	W-15 (W-34)	1926
7.	W-95-4	1711
8.	W-122-23-7	1048
*9.	Pinto 114	1930
*10.	Tara (Great Northern)	906
11.	Snowflake	1547

Length of rows harvested - 20 ft.
Row width - 3 ft.
Area harvested per plant - 120 ft.

* Pinto beans

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Increasing Water Use Efficiency of Smooth Bromegrass Through Plant Selection

Red-75-4

By James G. Ross, professor, Plant Science Department

Introduction

The objective of this research is to obtain, through plant selection, a variety of smooth bromegrass which will continue to produce forage during the summer, and remain in mixture with alfalfa under an intensive harvesting program designed to maximize alfalfa yields.

Procedure

Bromegrass was seeded one seed to a hill, 40 inches each way in the fall of 1969 on 6 acres of irrigated land. The next spring alfalfa was overseeded and in subsequent seasons harvested to give maximum yield. In 1973 and 1974 harvests were made on or about May 30, June 29, August 10, and October 9.

Results and Discussion

Outstanding plants have been marked before each cutting in each year. The identity of outstanding plants has in this fashion been maintained. On May 3, 1973, and May 14, 1974, the plants which had consistently given good regrowth the previous year were marked with a wooden permanent stake. Small plastic stakes were used to mark the outstanding plants before each harvest during 1973 and 1974. A similar technique will be followed in 1975. The plants which have consistently given good regrowth eventually will be removed from the field, tested for desirable agronomic characteristics such as seed set, disease and forage quality and the best of these placed in a synthetic for testing.

In addition to this nursery another nursery was established in August, 1973, from outstanding plants in the Brookings nursery. These were overseeded with alfalfa in the spring of 1974 and subjected to a harvesting regime similar to the other nursery.

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Agricultural Experiment Station South Dakota State University, Brookings

Grass Regrowth Experiment

Red-75-5

By James G. Ross, professor, Plant Science Department.

Introduction

This experiment was designed to study the comparative regrowth of a new synthetic variety of smooth bromegrass (SD 5), and a new synthetic variety of creeping foxtail (SD 101) with standard varieties and species.

Material and Methods

On August 29, 1974, the following varieties were seeded: SD 5 and Lincoln smooth bromegrass, SD 101 and Garrison creeping foxtail, Oahe and Slate intermediate wheatgrass, Nordstern orchardgrass, and commercial reed canarygrass. These were seeded alone at 10 lbs/acre of grass seed and in mixture at 8 lbs/acre of grass seed with 8 lbs/acre alfalfa. Rows were 1 foot apart in 4-row plots 21 feet long with 4 foot pathways. A split plot design of randomized complete blocks was used to study the performance of the varieties with and without alfalfa. Harvest will be made four times during the growing season under conditions of optimum fertility and water availability.

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Red-75-6

Seed Production of Kentucky Bluegrass Varieties Under Irrigation

By James G. Ross, professor, Plant Science Department.

Introduction

The objective of this experiment was to investigate the seed yield potential of lawn grass varieties of Kentucky bluegrass under irrigation.

Procedure

On August 22, 1972, a 4-replicate test of 7 varieties of Kentucky bluegrass was established (Table 1). Each plot consisted of 4 rows, 1 foot apart and 46 feet long. In April, 1973, 60 lbs/acre of nitrogen in the form of ammonium nitrate was applied. Nitrogen in the form of ammonium nitrate was applied in early April, 60 lbs. in 1973 and 80 lbs. in 1974. On May 1, 1974, the plots were sprayed with 2,4-D amine to control weeds. The plots were irrigated as required.

Results and Discussion

As shown in Table 1, seed production was very low in 1973 since this was the year of establishment, but was much higher in 1974. S.D. Certified (312 lbs/acre) produced more seed than other strains and withstood lodging better than all other varieties except P-59 under these conditions of high fertility and optimum moisture. Park (164 lbs/acre) and P-59 (167 lbs/acre) yielded next to S.D. Certified. S.D. Certified and Park had little or no damage from insects which cut through the stem causing sterile panicles. The other varieties showed varying degrees of damage. The lower yielding varieties tended to produce smaller number of heads. P-162 produced very few heads in some replicates.

Table 1. 1973 and 1974 Seed Yields of Lawngrass Varieties of Kentucky Bluegrass Planted on August 22, 1972, Under Irrigation.

Variety	Seed Yields, lbs/acre	
	1973	1974
S. Dak. Certified	29.8	312
Park	44.0	164
P-59	19.6	167
P-141	10.5	116
P-143	19.4	108
P-162	22.1	48
P-170	38.1	69

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Alfalfa Management with Irrigation

Red-75-7

By Raymond Ward, former research manager, and

Robert Sanders, farm manager, James Valley Research and Extension Center.

Summary

Iroquois and Saranac alfalfa varieties were higher yielding than Vernal at all three stages. Full bloom harvest stage produced the highest yields but may not have produced the most crude protein and TDN.

Introduction

This alfalfa management study was conducted to compare yields of three newer varieties of alfalfa and to measure their yields when harvested at three stages of growth.

Procedure

The alfalfa was planted in May 1973. The alfalfa was not fertilized because soil tests for P and K were high. The alfalfa was irrigated as needed during July and August. June irrigations were limited to 1½ inches due to a delay in getting new sprinkler equipment installed.

The alfalfa yields were harvested with a field swather. Hay samples were collected when windrows were weighed for moisture and feed analyses. All hay yields were corrected to 12% moisture in the hay. Protein and TDN analysis are planned but have not been completed at the time of this report.

Results and Discussion

Table 1 shows the dates alfalfa was harvested for the three stages of development.

A killing frost was received September 20th. A light freeze occurred September 3rd.

Yields of the three varieties of alfalfa at the three harvest stages are illustrated in Table 2. Yields of the first cutting are much larger than the other cuttings. The lack of irrigation water in June is also reflected in yields of the second cutting.

Highest tonages were obtained from the Flemish type alfalfa (Iroquois and Saranac). Regrowth of these two varieties were much faster than with Vernal.

Alfalfa cut at full bloom gave the greatest total yield but may not be the best quality hay because protein is usually lower when hay is harvested at this stage.

Hay harvesting requires more management when harvested in the bud or early bloom stage because the alfalfa contains more moisture and it cures slower. When harvesting irrigated alfalfa at these stages a hay conditioner should be used to aid curing.

Table 1. Date of each harvest

	Cuttings			
Harvest Stage	First	Second	Third	Fourth
Bud	6/3	7/3	7/24	8/28
1/10 Bloom	6/14	7/9	8/5	9/20
Full Bloom	6/21	7/11	9/20	—

Table 2. Effect of harvesting three alfalfa varieties at different stages of development.

		Cuttings				
Harvest Stage	Variety	First	Second	Third	Fourth	Total
			Tons per acre			
Bud	Vernal	1.82	1.05	0.99	1.24	5.10
	Iroquois	1.91	1.23	1.25	1.38	5.77
	Saranac	2.19	1.04	1.27	1.41	5.91
1/10 Bloom	Vernal	2.31	0.74	1.38	0.93	5.36
	Iroquois	2.79	0.95	1.61	1.27	6.62
	Saranac	2.58	1.22	1.48	1.25	6.53
Full Bloom	Vernal	2.67	1.17	1.70	—	5.54
	Iroquois	3.22	1.53	1.94	—	6.69
	Saranac	3.14	1.80	2.08	—	7.02

LSD .05 = .30 T/A

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Red-75-8

Small Grain Variety Testing at Redfield 1974

By Raymond Ward, former research manager, JVREC,
and J. Duane Colburn, associate professor, Plant
Science Department.

Summary

Early maturing varieties were usually higher yielding than later maturing ones. This was true for wheat, oats, and barley. Semi-dwarf varieties of spring wheat were higher yielding than tall varieties. Protor, MP-19-D and W.S. 1809 varieties produced about 37 bushels per acre. Rollette was the superior durum wheat. Chief, Froker, S.D. 955, and Diana were the highest performing oat varieties. Four barley varieties performed similarly with Primus II being the top yielder.

Introduction

The value of newly developed small grains must be tested under various climatic conditions to find the most suitable varieties under certain conditions. Producers are always evaluating varieties but it is difficult to get an unbiased look at a large number of varieties. The purpose of this experiment was to provide yield comparisons of many varieties grown under the same soil and climatic conditions.

Procedure

The small grains were planted April 19th with a press drill equipped with double disk openers (spaced 6 inches apart) and a special seed feeding apparatus for changing varieties easily. A seeding rate of 75 lbs. per acre was used for all small grains. The varieties were planted in wheat land that had been tandem disked twice in the fall and once before seeding.

Soil tests for N, P and K were very high so no fertilizer was applied. The plot area was sprayed with MCP to control broadleaf weeds.

Harvesting was completed with a small self-propelled combine. Yield values are averages of seven subsamples.

Results and Discussion

Table 1 shows the yields of 19 varieties of hard red spring wheat. The three highest yielding varieties were the semi-dwarf varieties Protor, MP-19-D, and W.S. 1809 (37.7, 37.2 and 36.5 bu/A, respectively). Waldron and Ellar were the highest yielding tall varieties with resulting yields 1 to 2 bu/A less than the semi-dwarfs. Six of the top eight varieties were semi-dwarfs. These results are consistent with other yield trials. It also appeared that the highest yielding varieties were slightly earlier in maturing than the lower yielding varieties. The extremely high temperatures about June 20th caused all varieties to head in 3 to 4 days, except Era which was later and consequently produced a low comparable yield.

Yield performance of the durum varieties is shown in Table 2. Rollette produced almost 5 bushels per acre more than other varieties. Hercules was much lower yielding than the other varieties.

Oat variety yield performance is shown in Table 3. Chief, a good early variety in South Dakota, performed very well as shown by the 82 bushel per acre yield. A new variety, SD-955, performed well compared to some of the more popular varieties. In general the highest yielding varieties were the early maturing varieties. An exception is Froker which produced a yield of 79.3 bushels per acre.

Table 4 displays the barley variety performance. The top four variety yields ranged from 50.0 to 46.8 bushels per acre. Primus II, the earliest maturing variety produced the highest yield. Larker and Cree were 7 to 10 bushels per acre lower yielding than Primus II.

(Over)

Table 1. Yields, heading dates and plant heights of the spring wheat varieties grown at Redfield.

Variety	Yield Bu/A	Heading Date	Ht. In.
Protor	37.7	6/21	29
MP-19-D	37.2	6/20	31
W.S. 1809	36.5	6/18	29
Waldron	36.1	6/21	38
Olaf	35.6	6/21	28
Ellar	35.0	6/21	35
Bonanza	33.9	6/21	23
Bounty 208	33.8	6/18	28
Nowesta	32.4	6/21	36
W.S.-3	32.4	6/20	24
Polk	31.9	6/22	36
Tioga	31.7	6/22	31
Minn. II-64-33	31.4	6/22	30
Sheridan	30.8	6/22	38
Era	28.2	6/24	28
Prodax	27.2	6/20	23
W.S.-6	27.2	6/20	26
Chris	25.0	6/22	32
Nordak	22.7	6/22	36
LSD .05	4.0		

Table 2. Yields, heading dates and plant heights of the durum wheats grown at Redfield.

Variety	Yield Bu/A	Heading Date	Ht. In.
Rollette	41.5	6/21	36
Botno	36.8	6/20	35
Leeds	36.3	6/25	36
Rugby	35.3	6/22	35
Crosby	34.1	6/21	35
Ward	33.9	6/21	37
Hercules	28.2	6/22	35
LSD .05	4.0		

Table 3. Yields, heading dates and plant heights of the oats grown at Redfield.

Variety	Yield Bu/A	Heading Date	Ht. In.
Chief	82.2	6/22	36
Froker	79.3	6/28	37
S.D. 955	77.5	6/21	37
Diana	77.1	6/20	33
Multiline E-74	70.2	6/19	33
Nodaway-70	69.0	6/21	35
Dal	68.4	6/29	32
Grundy	65.0	6/20	33
Otee	63.0	6/22	31
Portal	63.0	6/24	36
Noble	62.7	6/22	33
Cayuse	62.3	7/1	34
Holden	61.6	6/23	34
Garland	60.8	6/23	34
Multiline M-73	59.6	6/22	37
Burnett	58.8	6/22	34
Kelsey	58.3	6/26	34
Astro	53.9	7/1	31
Trio	51.3	6/19	35
LSD .05	8.3		

Table 4. Yields, heading dates and plant heights of the barley varieties grown at Redfield.

Variety	Yield Bu/A	Heading Date	Ht. In.
Primus II	50.0	6/11	35
Beacon	49.2	6/17	36
Manker	48.9	6/17	35
Prilar	46.8	6/16	39
Larker	42.7	6/17	36
Cree	40.3	6/18	35
LSD .05	5.2		

James Valley Agricultural
Research and Extension Center
Redfield, S.D. 57469

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progress report

Agricultural Experiment Station South Dakota State University, Brookings

Red-75-9

Oat Forage Experiment

By Raymond Ward, former research manager, JVREC, and Dale Reeves, assistant professor, Plant Science Department.

Summary

Ten oat varieties were grown to measure forage production. The early maturing variety, Diana, produced the highest yields. Harvesting in the dough stage produced 0.4 tons more hay or 1.0 tons more silage per acre than harvesting in the milk stage. Feed quality analyses will be available later.

Introduction

Many farmers and ranchers in central South Dakota are interested in growing oats as a forage or hay crop instead of as a grain crop. The objectives of this research were: (1) to find the best forage yielding oat variety; (2) to measure yield differences when harvested in the milk or dough stages; and (3) to determine any differences in protein and TDN.

Procedure

Oat forage yields were taken when the kernels towards the top of the head were in the milk stage and in the dough stage. Yields were estimated by weighing a 15 by 7.5 foot area that had been cut with a self-propelled swather.

The 10 oat varieties shown in Table 1 were planted April 5, 1974 in Field 16 at the James Valley Agricultural Research and Extension Center, Redfield. About 3 bushels of grain were planted per acre. Soil moisture was moderate and soil fertility was very high. The experiment was sprayed with 3/4 quart of 2,4-D amine per acre May 20, 1974.

Oats were planted on spring wheat land that had been tandem disked twice the previous fall and once just before seeding.

Results and Discussion

The yield results are shown in Tables 1, 2 and 3. The early heading and harvest dates were due to the early April planting and high temperatures the latter part of June and in July. The early maturing varieties, such as Diana and Multiline M-73, were higher yielding when harvested in the milk stage than later maturing varieties. A harvest delay so that the oats were in the dough stage increased yields (Table 1) for 7 of 10 varieties. Forage yields were not increased for Multiline M-73, Trio and Portal.

When the yields for both harvests are averaged as shown in Table 2 Diana is the highest yielding variety. Several other varieties are quite similar in yield and Mammoth is lower than all other varieties.

The protein and TDN analyses have not been completed, therefore differences in feed quality between milk and dough stage cannot be shown at this time. The analyses may be obtained at a later date by writing to Dr. Reeves.

(Over)

Table 1. Hay and silage yields of 10 varieties of oats grown at Redfield.

Variety	Hay Yields (ton/acre)* Milk Stage	Hay Yields (ton/acre)* Dough Stage	Silage Yields (ton/acre)** Milk Stage	Silage Yields (ton/acre)** Dough Stage	Date Headed	Date Harvested Milk Stage	Date Harvested Dough Stage
Diana	3.6	4.4	9.1	11.0	6/15	6/27	7/5
Multiline M-73	3.6	3.4	9.1	8.5	6/18	6/27	7/5
Trio	3.5	3.5	8.7	8.8	6/15	6/27	7/5
Portal	3.3	3.3	8.4	8.3	6/20	6/27	7/5
Chief	3.3	3.7	8.3	9.2	6/19	6/27	7/8
Burnett	3.3	3.9	8.3	9.9	6/19	6/27	7/8
Dal	3.2	3.8	8.0	9.6	6/25	7/2	7/8
Froker	3.2	4.0	8.0	10.2	6/23	7/2	7/8
Kelsey	3.1	3.9	7.9	9.7	6/23	7/2	7/8
Mammoth	2.5	2.8	6.2	7.1	6/28	7/2	7/8
LSD (.05)	0.4	0.4	1.1	1.1			

* Corrected to 12% moisture in the hay.
** Corrected to 65% moisture in the silage.

Table 2. Hay and silage yields of oats when averaged for two harvest dates (Redfield).

Variety	Hay, tons/acre*	Silage, tons/acre**
Diana	4.0	10.0
Multiline M-73	3.5	8.8
Trio	3.5	8.8
Portal	3.3	8.3
Chief	3.5	8.7
Burnett	3.6	9.1
Dal	3.5	8.8
Froker	3.6	9.1
Kelsey	3.5	8.8
Mammoth	2.6	6.6
LSD (.05)	0.5	1.3

* Corrected to 12% moisture in the hay.
** Corrected to 65% moisture in the silage.

Table 3. Effect of harvest date on yield of oats for hay or silage (Redfield).

Harvest Stage	Hay, tons/acre	Silage, tons/acre
Milk	3.3	8.2
Dough	3.7	9.2
LSD (.05)	0.2	0.5

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Red-75-10

Effects of Seeding Rates and Irrigation on Wheat Yields

By Raymond Ward, former research manager, JVREC, and Robert Pylman, Jr., spring wheat breeder, Plant Science Department.

Summary

Irrigation during the dough stage with 3 inches of water increased the yield of all varieties of wheat tested by 6 bushels per acre. Seeding rate did not increase yields of all varieties and generally increasing the seeding rate from 70 to 130 lbs. per acre increased the yield less than 3 bushels per acre.

Several varieties were high yielders in the test (W.S.-6, Protor, Bounty 208, Waldron and Olaf). Test weight was higher for Bounty 208 and Protor. Seeding rate did not affect test weight. The late irrigation reduced test weight about one pound per bushel with differences greater than this for some varieties.

Introduction

There are some indications that semi-dwarf varieties of wheat need to be planted at higher seeding rates than the conventional varieties. This is especially true when moisture conditions are good so that high yields can be obtained. The yield potential of wheat varieties under irrigation need to be studied to determine the feasibility of irrigating this crop. The objectives of this experiment was to determine yields of eight varieties of wheat at different seeding rates when irrigated.

Procedure

The plot was seeded April 24th on soybean ground that had been tandem disked once and harrowed twice. Fertilizer application was 100 lbs. of 0-46-0 per acre. No nitrogen was applied because of the previous crop of alfalfa followed by soybeans. The site was sprayed with 2,4-D amine to control weeds. The wheat was harvested August 2nd with a small plot self-propelled combine.

Results and Discussion

The yield results are shown in Table 1. There were significant or real differences in performance of the varieties due to irrigation.

Irrigation was limited to boot stage and dough stage. The additional 3 inches of water applied at the dough stage increased the yields about 6 bushel per acre. This was an interesting result and shows that late watering can be very beneficial if conditions are hot and dry as in 1974.

The seeding rates were not significantly different but shows a trend toward higher yields at thicker seedings. The economics of higher seeding rates will depend mostly on cost of the additional seed.

The highest performing variety was W.S.-6. Protor, Bounty 208, Waldron and Olaf yields were 1 to 1½ bushels less per acre than W.S.-6. Later maturing varieties such as Era and Olaf produced larger yield increases when irrigated in the dough stage than Bounty 208 or W.S. 1809. This could imply that later maturing varieties need moisture later in the season to produce their highest yields. Heading dates for the eight varieties are shown in Table 2.

Test weights are shown in Table 3. Bounty 208 and Protor produced the highest test weights, while the lowest test weights were obtained from W.S.-6.

Seeding rates did not affect test weights for the varieties enough to indicate any real differences. Irrigation at the dough stage reduced test weights about one pound per bushel. Test weights of some varieties were lowered more by the late irrigation than others as shown by Table 3. Although test weight was reduced the yields were increased by the dough stage irrigation.

(Over)

Table 1. Effects of seeding rates, varieties and irrigation rates on wheat yields, 1974.

Variety	Seeding Rate, bu/A	Irrigation 3"*	6"**	Ave.
Waldron	70	37.5	45.9	41.7
	100	40.2	46.3	43.3
	130	43.8	48.5	46.2
Average		40.5	46.9	
W.S. 1809	70	37.7	38.7	38.2
	100	34.9	37.4	36.2
	130	36.1	42.5	39.3
Average		36.2	39.5	
Era	70	35.8	44.1	40.0
	100	37.4	46.2	41.8
	130	39.9	45.9	42.9
Average		37.7	45.4	
Bounty 208	70	39.0	47.2	43.1
	100	41.6	44.6	43.1
	130	42.4	47.4	44.9
Average		41.0	46.4	
Olaf	70	39.3	46.3	42.8
	100	38.6	49.6	44.1
	130	41.3	49.3	45.3
Average		39.7	48.4	
Minn. II-64-33	70	37.7	43.0	40.4
	100	40.5	44.4	42.5
	130	39.8	45.9	42.9
Average		39.3	44.4	
Protor	70	40.4	42.8	41.6
	100	42.6	44.4	43.5
	130	43.6	48.1	45.9
Average		42.2	45.1	45.9
W.S.-6	70	41.5	49.1	45.3
	100	40.5	48.4	44.5
	130	43.1	48.0	45.6
Average		41.7	48.5	
Grand Average		39.8	45.6	41.6
				42.4
				44.1

* 3" at heading; ** 3" at heading, 3" at dough.
NOTE: Statistical analysis of variance showed differences between varieties and between the two rates of irrigation.

Table 2. Heading dates for the eight varieties of wheat.

Variety	Heading Date June
Waldron	21
W.S. 1809	18
Era	24
Bounty 208	19
Olaf	23
Minn. II-64-33	24
Protor	20
W.S.-6	21

Table 3. Effects of seeding rates, varieties and irrigation rates on test weight, 1974.

Variety	Seeding Rate, bu/A	Irrigation 3"*	6"**	Ave.
Waldron	70	58.3	57.5	57.9
	100	58.4	57.8	58.1
	130	57.3	57.3	57.3
Average		58.0	57.6	
W.S. 1809	70	58.0	57.3	57.7
	100	59.0	58.5	58.8
	130	58.8	59.2	59.0
Average		58.6	58.3	
Era	70	60.5	57.8	59.0
	100	60.8	59.5	60.1
	130	60.5	58.2	59.2
Average		60.0	58.3	
Bounty 208	70	60.1	60.9	60.5
	100	60.9	59.8	60.3
	130	61.1	60.5	60.8
Average		60.8	60.3	
Olaf	70	59.5	57.2	58.3
	100	59.0	58.8	58.9
	130	59.1	58.2	58.7
Average		59.2	58.1	
Minn. II-64-33	70	58.0	56.9	57.4
	100	58.5	56.9	57.8
	130	58.8	56.9	57.8
Average		58.4	56.7	
Protor	70	60.6	59.7	60.0
	100	60.3	60.5	60.4
	130	60.8	61.2	61.0
Average		60.6	60.3	
W.S.-6	70	56.5	56.5	56.5
	100	57.8	56.8	57.3
	130	57.0	56.2	56.6
Average		57.0	56.6	
Grand Average		59.2	58.3	58.4
				58.9
				58.8

* 3" applied at heading.
** 3" applied at heading and 3" at dough stage.
NOTE: Analysis of variance showed differences between varieties, irrigation treatments and also showed that some variety test weights responded differently to irrigation than others.

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Red-75-11

Wheat Quality Discussion of 1973 Data at Redfield

By Robert W. Pylman, Jr., spring wheat breeder,
Plant Science Department.

Flour quality means different things to the ultimate user of the product. It usually represents conformance to several measurable characteristics which experience has indicated to be significant in terms of the end use.

The following quality characteristics are presented for the purpose of showing some of the differences which exist between varieties for some of the characters involved with milling and baking evaluation of Hard Red Spring Wheats.

Test Weight

One of the most widely used and simplest criteria of wheat quality is the weight of the wheat per unit volume. Kernel size, as such, has little if any influence on test weight. Kernel shape and uniformity of kernel size and shape are important factors influencing test weight, inasmuch as they affect the manner in which the kernels orient themselves in a container. The other important factor influencing test weight is the density of the grain. Density, in turn, is influenced by the biological structure of the grain and its chemical composition, including its moisture content.

Weight per unit volume is an important factor in all wheat grading systems. Its importance lies primarily in the fact that it is at least a rough index of the yield of flour that can be obtained. There is considerable evidence that above about 57 lb. per bushel the test weight of wheat has relatively little influence on flour milling yield. At lower weights the milling yield usually falls off rather rapidly with decreasing test weight. Immature wheat or wheat that is badly shriveled as a result of drought or disease is usually low in test weight and gives correspondingly poor yield of flour. The average test weight per bushel of U.S. wheat is 60 lbs., but test weights up to 64 lbs. are not uncommon. Badly shriveled wheats may have test weights as low as 45 lbs. or less.

Protein Content

Protein content in wheat varies from about 6% up to about 20%, depending in part on variety and class but more largely on environmental factors during growth. Abundant rainfall during the period of kernel development usually results in low protein content, whereas dry conditions during that period favor high protein content of wheat.

For the production of yeast-leavened bread, flour with a protein content of at least 11% is usually preferred. To produce such flour the wheat must have a protein of at least 12%. This factor has been of concern in semi-dwarf wheats. Larger differences than 1% protein between whole wheat and flour protein have been reported for semi-dwarfs. This apparently doesn't seem to be a problem in South Dakota. In many counties climatic conditions make it impossible to produce wheat of that protein content level, and as a result these counties usually import wheat of high protein content to blend with their local wheat. In the U.S. premiums are usually paid for hard wheat of high protein content, since such wheat is in demand for blending with lower protein wheat for the production of bread flour. Hard wheat in the U.S. is usually marketed on the basis of protein content in addition to grade.

Flours for purposes other than yeast-leavened bread generally are made from wheats of lower protein content, the approximate wheat protein content levels usually required for flour for different uses are shown in the following tabulation:

End Product	Wheat Protein Content (14% moisture basis) Percent
Macaroni products	13 or more
Hearth bread and hard rolls	13-14
Pan bread	12-13
Crackers	10-11
Biscuits	8.5-10.5
Cake	9-9.5
Pie crust	8-10
Cookies	8-9

Ash Content

The ash content of wheat is related to the amount of bran in the wheat and hence have rough inverse relationships to flour yield. Small or shriveled kernels usually have more bran on a percentage basis and therefore more ash, and yield less flour than large plump kernels. In annual early-season crop-quality surveys, millers often locate those areas of production which ash content of the wheat is low,

and then tend to give preference to wheat from those areas. Low ash content would be 0.43 to 0.45 and 0.60 would be high ash content.

Flour products which contain higher levels of ash are darker in color and may be assumed to contain greater quantities of fine bran particles or of that portion of the endosperm adjacent to the bran. Ash content is closely related to the color-influencing components of the flour (bran).

Flour Extract

Most of the physical criteria of wheat quality discussed above are based on relatively simple examinations or tests and are of value inasmuch as they reflect in some degree the milling quality of the wheat or the baking quality of the flour milled from the wheat. In experimental milling operations the yield of straight-grade flour, or semolina in the case of durum wheat, is the most important factor. Although various other characteristics are also considered in judging over-all milling quality (such as protein quantity and quality, moisture content, crude fiber, ash, etc.).

Mixing Time

Tests which evaluate mixing characteristics of gluten development in a dough are made by recording dough mixers. Mixing time is a function of protein quantity and quality as it effects the strength of flour.

Loaf Volume

The major factor accounting for variation in loaf volume within a variety is protein content. The relationship between loaf volume and protein content is essentially linear. Loaf volume at a given protein level, i.e. 13% increases sharply with mixing time from about 7/8 to about 3 minutes. Beyond 3 minutes, loaf volume at 13% protein is approximately constant with longer mixing time. Thus mixing times longer than 4-5 minutes are costly in the production of loaf bread.

Irrigation tended to lower all characteristics except percent of flour ash and mixing time. These two which were higher are related to less test weight and lower protein, respectively. Large loaf volume is highly associated with higher protein and thus would normally decrease in this test. Mixing time varied little for all but Era. The test weight for Era dropped severely under irrigation and would explain substantial decrease in flour extract and increase in mixing time and loaf volume. Era being a late variety may have been harvested too early when grown under irrigation.

Table 1. 1973 Redfield HRS Wheat Quality Data.

		Test Weight	% Whole Wheat Protein	% Flour Protein	% Flour Extract	% Flour Ash	Mixing Time	CC. Loaf Volume
Era	1)	63.0	12.3	11.3	66.2	0.50	3.50	184
	2)	59.0	12.4	11.3	53.0	0.63	6.75	192
Bonanza	1)	62.0	14.3	13.3	61.7	0.47	7.00	185
	2)	62.5	12.9	11.9	57.9	0.49	7.00	180
W.S. 1809	1)	62.0	13.7	12.6	64.3	0.47	5.25	193
	2)	62.5	13.9	12.8	63.2	0.50	5.25	186
Lark	1)	63.0	13.4	12.1	60.9	0.48	7.50	176
	2)	63.0	12.7	11.8	61.9	0.49	7.50	169
Bounty 208	1)	63.0	13.5	12.8	61.5	0.47	6.75	195
	2)	63.5	13.3	12.5	60.5	0.49	6.50	174
Waldron	1)	61.5	14.7	14.0	61.2	0.50	5.00	206
	2)	62.0	13.9	13.1	60.3	0.51	4.50	186
Olaf	1)	62.0	14.8	13.9	60.8	0.47	3.75	233
	2)	62.0	13.2	12.3	59.3	0.51	3.75	190
Nowesta	1)	62.0	14.7	13.5	59.3	0.44	6.75	200
	2)	62.5	13.6	12.7	57.7	0.45	4.50	193
Minn. II-64-33	1)	60.5	14.4	13.7	60.1	0.49	4.25	195
	2)	60.5	13.2	12.8	58.5	0.51	4.25	180
1) Dryland		62.1	14.0	13.0	61.8	0.48	5.53	196
2) Irrigated		61.9	13.2	12.4	59.1	0.51	5.56	183

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Red-75-12

Reclamation and Improvement of Claypan Soils

By L. O. Fine, professor, Plant Science Department

The experiments concerned with the reclamation and improvement of claypan soils were continued at a satellite location 5 miles NW of the Center.

One major modification was made in that the west 1/2 of each of 24 plots was plowed (about 7 1/2 inches deep) out of alfalfa in September, 1973, preparatory to planting to corn in 1974. Eight of these were treated with 10 T gypsum per acre, eight with 10 T fly ash (from the Hoot L., Minn, power plant) and eight left untreated; all were in the irrigated portion of the experiment.

In the spring of 1974, nine additional plots (W 1/2 of each) were plowed out of alfalfa and prepared for corn planting. These were all in the non-irrigated portion of the experiment.

In the fall of 1974, all the remaining alfalfa plots were broken out by chisel-plowing to a depth of about 7 inches. All of the land is to be planted to row crops in 1975.

Results for 1974

Water and water quality. A restriction on water use from the State Office of Water Resources limited pumping to apprxomately 3 inches for the irrigated area of the experiment. This limited performance of the crops being tested--corn and alfalfa. The James River water used ranged from 953 to 1089 in specific conductance (micromhos/cm) and from 2.59 to 3.51 in sodium adsorption ratio.

Only one irrigation, the first, applied to the alfalfa plots only, resulted in any drainage water appearing in the drain lines. Main drain sump samples and the James River on June 12 had electrical conductance values and SAR values as given in the following table.

Date	Water Source	Specific Conductance, Micromhos/cm	Sodium Adsorption Ratio
6/12	James River	953	0.93
6/10	Main Sump	769	0.97
6/11	Main Sump	757	0.97
6/12	Main Sump	741	0.98

The possible explanation of the high quality water being found in the drain lines is the same as in previous years: winter and spring precipitation had replenished the soil reservoir with high quality water which dissolved no appreciable additional salts from the soil. It is hypothesized that channels are being formed which serve as water conductors without permeating the main mass of the soil.

Pre-irrigation rainfall in May resulted in tile flowage which continued from May 21 to June 4. The quality of these waters on 4 sampling dates are:

Date	Source	Specific Conductance, Micromhos/cm	Sodium Adsorption Ratio
5/21	Main drain	791	0.035
5/22	Main drain	671	0.035
5/31	Main drain	753	0.92
5/31	#2 sump	1760	3.93
6/4	Main	780	1.19
6/4	#8 sump	2870	2.54

Crop Yields and Performance

Alfalfa. After the first harvest of alfalfa plots, grasshoppers moved into the experimental area in considerable numbers from surrounding non-irrigated cropland and native grass pasture.

All plots were aerially sprayed with toxaphene about July 10 and malathion August 4 for hopper control. The first spraying was unsuccessful, with the result that the normal second crop of alfalfa was a complete loss. Cuttings were made on June 19 and 20 and on September 4th.

Yields are summarized below.

Treatments of Plots

Deep-Plowed		Shallow-Plowed	
Irrigated Hay Yields,	Non-irrigated lbs. per A @	Irrigated 15% moisture	Non-irrigated Two cuttings
7392	6382	6092	4242

Corn. The heavy infestation of grasshoppers destroyed the corn silks as they emerged for about 10 days; however, after the second spraying, pollination did occur on most ear shoots and fairly mature corn was produced and harvested. Weed control was excellent, but because of depredations of deer, cattle and grasshoppers, and mis-matched cultivator and planters, stands and ear filling were below desirable levels.

The corn yields produced and harvested, as averages of four replications, are summarized below, in bu/A of corn at 15% moisture.

Treatments of Plots

Deep-Plowed		Shallow-Plowed	
Irrigated	Non-irrigated	Irrigated	Non-irrigated
86.2	50.4	76.5	50.4

This experiment will be terminated in 1976. Because of the physical difficulties in handling alfalfa at this remote location, all plots will be planted to row crops in 1975, to reduce difficulties in handling the produce and the machinery requirements.

In 1975, major emphasis will be on crop performance of selected row crops and on water quality in drains as influenced by land treatment.

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Red-75-13

Irrigation Application Depth

By Darrell W. DeBoer, associate professor
Agricultural Engineering Department.

The irrigation application depth study was continued in 1974. The purpose of the study is to determine the effect of 1-, 2- and 3-inch sprinkler irrigations on corn yields. The following table summarizes the results of this experiment for the past 3 years.

Corn yields (bu/ac) from irrigation application depth study

	Application Depth		
Year	1 in.	2 in.	3 in.
1972	123.2	118.4	123.9
1973	124.9	116.2	116.2
1974	61.6	66.9	58.1

An analysis of these results indicates no difference in corn yields caused by the three application depths. The 1974 yields are not representative of irrigated corn at the Center. The plots were subjected to a short growing season in 1974 and the particular corn variety did not produce well developed ears. Reference can be made to other 1974 corn yields in this publication. (WRI #3540).

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Center Pivot Machine Management

Red-75-14

By Darrell W. DeBoer, associate professor,
Agricultural Engineering Department.

A new sprinkler irrigation research project was initiated at the James Valley Research and Extension Center in 1974. The basic objective of the field work is to obtain crop yield and soil moisture extraction data from corn, alfalfa and soybean plots which will receive different amounts of irrigation water during the growing season. Irrigation water is applied to the crops according to specified center pivot irrigation machine management practices. Corn and soybean yields, collected in 1974, were less than optimum because of a late planting date (early June) and an early frost (early September). The short growing season of 1974 could have a masking influence on trends to expect in a normal year. The following table summarizes the crop yield data for 1974.

Crop yields from the center pivot machine management study

	Yields	
Treatment	Corn (bu/A)	Soybeans (bu/A)
Dryland	83.5	31.6
1 in./4 days	103.4	25.2
1 in./6 days	105.3	25.7
1 in./8 days	104.5	25.1
1 in./12 days	105.4	27.5

Irrigation was initiated on July 22 immediately after the plot irrigation system was completed. The 1 in./4 days treatment represents the situation where an irrigation system applies 1 inch of irrigation water every 4 days. Other irrigated treatments represent longer irrigation periods or times between irrigations.

All irrigation treatments produced about the same corn and soybean yields. However, the dryland corn yield was less than the irrigated yield while the reverse was true for the soybeans. The corn variety was DeKalb XL21A at a harvest population of 23,820 and the soybean variety was Wells planted at a rate of 61 lbs/A. (SD #636, WRI #3542).

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progress report

Agricultural Experiment Station South Dakota State University, Brookings

Red-75-15

Sunflower Insect Research in South Dakota—1974

By Robert J. Walstrom, professor and head,
Entomology-Zoology Department.

Light Trap Survey

An insect light trap equipped with a fluorescent black-light bulb was operated in the sunflower plots on the station from June 28 through August 28, 1974. Collections were generally removed and frozen for preservation each morning by station personnel. Frozen collections were taken to the Entomology-Zoology Department at Brookings each week where insects of major importance were identified and counted. Thirty-three different species were collected. The majority of the species were aquatic or non-economic species. Nine species of possible economic importance to sunflowers were noted. These were:

Possible Beneficial Species--
- Harpalus sp. - (Carabidae)
- Arradaptus sp. - (Carabidae)

Possible Injurious Species--
- Adelphosoris lineolatus (Goeze) - (Miridae)
- Agrotis ipsilon (Hufnagel) - (Noctuidae)
- Homoeosoma electellum (Hulst) - (Pyralidae)
- Ostrinia nubilalis (Hubner) - (Pyralidae)
- Agonoderus lecontei Chaudoir - (Carabidae)
- Melanotus sp. - (Elateridae)
- Ochodaeus sp. - (Scarabaeidae)

The H. electellum or sunflower moth is the only trapped species which is known to be a major sunflower pest species. This insect had peaks in numbers collected on July 10, July 25 and August 21 which indicate a strong possibility of three generations for this insect each season in South Dakota. Other workers have considered this insect to have only a single generation per year.

Other species of insects known to damage sunflower plants which were not collected by the light traps but which were collected in the Redfield plots are as follows:

Strausiz longipennis (Wiedemann) - sunflower maggot
Zygogramma exclamationis (Fabr.) - sunflower beetle
Rhynchites aeneus Boh. - sunflower curculio
Smicronyx soridutus LeConte - (small yellow curculio)
Smicronyx fulvus LeConte - (small black curculio)

Sunflower Variety - Date of Planting Study

The effect of insects on sunflower yields was studied at the Redfield station in cooperation with other Experiment Station personnel. The design of the plots and the procedures are as described in the Redfield Research Progress Report No. 16, "Sunflower Production in North Central South Dakota."

In addition to the light trap survey, inspections of the plots were made at intervals during the 1974 growing season to determine insect species present.

It is to be noted that the two insects causing identifiable damage in 1974 were the sunflower moth and the sunflower curculio.

On September 4, 1974, ten sunflower heads were harvested at random from each plot, sealed in plastic, and returned to the campus for specific insect and bird damage determination. The results of this study are as follows:

(Over)

Variety	Rep.	Percent Reduction in Harvestable Seed: Sunflower Moth Damage	Sunflower Curculio Damage	Total Insect Damage	Bird Damage	Total Damage
Planted May 3						
Issanka	1	2.9	0.0		21.6	
	2	54.0	0.0		43.5	
	Average	28.5	0.0	28.5	32.6	61.1
Peredovik	1	67.5	0.0		28.5	
	2	30.5	0.0		50.0	
	Average	49.0	0.0	49.0	39.3	88.3
Record	1	43.1	20.0		34.4	
	2	45.0	0.0		44.5	
	Average	44.1	10.0	54.1	39.5	93.6
Planted May 17						
Issanka	1	10.7	0.0		35.2	
	2	45.0	10.0		19.5	
	Average	27.9	5.0	32.9	27.4	60.3
Peredovik	1	52.0	0.0		40.0	
	2	32.5	0.0		38.0	
	Average	42.3	0.0	42.3	39.0	81.3
Record	1	50.0	10.0		36.9	
	2	9.5	0.0		37.0	
	Average	29.6	5.0	34.6	36.9	71.5
Planted May 29						
Issanka	1	30.6	10.0		37.8	
	2	23.9	0.0		27.2	
	Average	27.3	5.0	32.3	32.5	64.8
Peredovik	1	4.9	10.0		27.8	
	2	7.7	0.0		38.0	
	Average	6.3	5.0	11.3	32.9	44.2
Record	1	22.5	0.0		30.0	
	2	1.6	0.0		29.5	
	Average	12.1	0.0	12.1	29.8	41.9

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Sunflower Production in North Central South Dakota

Red-75-16

By R. C. Ward, former research manager, JVREC; Paul L. Carson, professor, Plant Science Department; John L. Skogberg and Marvin W. DeHoogh, County Extension Agents (Walworth, Brown counties).

Summary

Several sunflower experiments were conducted. Variety performance varied from location to location. The highest yielders were: Walworth County--Cargill 101; Brown County--Peredovik; Redfield (dryland)--HS-52; and Redfield (irrigated)--HS-52.

Nitrogen fertilizer did not increase yields, probably because residual soil nitrates were high. Plant populations should be moderate (13,000 to 15,000 plants per acre) for highest yields. The highest producing planting date was May 29th at Redfield.

Introduction

Sunflower production has found a place in the cropping systems of northern South Dakota. Several demonstrations and research studies were conducted in 1974 to study the effects of varieties, fertilizers, plant population, planting dates, and irrigation on the yields of sunflowers. A subsequent report will discuss the insect problems with sunflowers.

Procedures

Walworth County. Sunflowers were planted, second week of May, on summer fallowed land located on the George and Keith Vojta farm southwest of Selby, S.D. The sunflowers were planted in thirty eight inch rows at a seeding rate of about 18,000 seeds per acre. The plots were hand harvested in September.

Brown County. A sunflower variety trial was planted about June 5th on stubble land located on the Alvin Ablin farm west of Groton, S.D. The sunflowers were planted in thirty inch rows at a seeding rate of 22,000 seeds per acre. The plots were hand harvested in September.

Fertilizer trials. Five nitrogen fertilizer rate trials were established in Brown and Spink Counties. The rates of nitrogen were repeated four times and were four rows wide by thirty feet long. The nitrogen was broadcast on the soil surface after the sunflowers were five to ten inches tall. Yield samples were taken by hand in September. One location in Spink County was not harvested because of soil variability.

James Valley Agricultural Research and Extension Center. Irrigated sunflowers were planted on three May dates. The land was corn in 1973. It was tandem disked twice after stalks were chopped, sprayed with Treflon for weed control and tandem disked twice again. The planting rate was 22,500 seeds per acre. No fertilizer was used. The sunflowers were cultivated once and then hilled for irrigation. Approximately ten inches of water were applied in four irrigations. Yields were taken by hand in September.

Dryland. Sunflowers were planted June 3 on corn silage land that had been tandem disked once and field cultivated twice. No herbicide or fertilizer was used. The sunflowers were cultivated twice and harvested by hand in September.

Results and Discussion

The highest yielding varieties at the Walworth County location were Cargill 101, Interstate 896 and Interstate 8946 as shown in Table 1. The yields were very good at this location which can be attributed to the summer fallow and concave slope position (better moisture).

The results of the variety trial in Brown County are presented in Table 2. This was a continuously cropped area. Planting date was delayed because of several rain showers. The yields were good with Peredovik, Issanka, Interstate 896 and Record varieties producing the highest yields. Plant populations were high at this location (18,000 to 20,000 plants per acre).

Nitrogen fertilizer trials were completed at four locations in Spink and Brown Counties. The resulting yields are shown in Table 3. The low yields were due to the extremely severe drouth encountered in the area during 1974. When one considers the conditions (dry and hot) sunflowers appear to have an economic importance in this semi-arid region.

The nitrogen fertilizer did not increase yields (Table 3). The high nitrate-nitrogen soil tests (Table 4) accounts for the lack of response to nitrogen. These data point out the importance of soil testing, especially with the high nitrogen fertilizer prices. Data gathered indicates a nitrate test should be below 60 lbs. of N per acre (total for 0-6, 6-12 and 12-24 inches) before nitrogen fertilizer is applied.

Four varieties of sunflowers were tested at the James Valley Agricultural Research and Extension Center in 1974. These yields are shown in Table 5 for two populations (planting rates) under dryland and irrigated conditions. Yields were lowered because of blackbirds feeding on the test areas. It was noted at harvest that some heads were 50% or more threshed by the birds. For dryland it appears that the thinner planting rate (17,000 seeds per acre) produced slightly more yield. The heads were larger at the thinner population and this may have cut down on bird damage. The thinner stand also means less plant competition thus more moisture per plant.

The thinner population produced more yield when irrigated which indicates the bigger heads tend to produce higher yields. The same type of results were obtained in 1973. The thinner planting rate produces larger heads which dry slower, thus a compromise on population is needed for high yields that dry rapidly may be reached. The dryland population (plants per acre) that best suits these needs is probably between 13,000 to 15,000 plants per acre at harvest time.

Planting date of sunflower varieties were studied at the James Valley Agricultural Research and Extension Center. The purpose was twofold: (1) measure yield differences and (2) follow insect populations for prediction of problems. This data will be reported in another progress report.

Planting date results show drastic differences in yield (Table 6). The early planting dates were observed to be more infected with insects and thus some reduction in yield. The blackbirds, mentioned previously, caused more damage on the early planted sunflowers than on those planted later. Thus, the yields of the early planted sunflowers are disproportionately lower. More work is needed on planting dates to fully evaluate the best planting time.

Table 7 shows the heading date (50% headed) of the varieties for each planting date.

Table 1. Sunflower variety yields at the Walworth County location, 1974.

Variety	Yield lbs/A
Cargill 101	1426
Interstate 896	1334
Interstate 8946	1280
Interstate HS-52	1200
Interstate 8941	1160
Interstate 8666	1059
Record	1046
Interstate 894	992
Sputnik	975
Interstate 8944	815
Peredovik	705

Table 2. Sunflower variety yields in Brown County, 1974.

Variety	Yield lbs/A	Population plants/A
Peredovik	1170	19,000
Issanka	1060	20,000
Interstate 896	1050	20,000
Record	1030	18,000
Interstate HS-52	940	18,000
Interstate 8666	880	20,000

Table 3. The effects of nitrogen fertilizer on the yields of sunflowers at four locations, 1974.

	Location and Cooperator			
N added lbs/A	Brown Co. Hansen	Brown Co. Tullis	Spink Co. M. Williams	Spink Co. H. Williams
	lbs/A			
0	1007	520	490	1080
30	950	530	450	960
60	1000	490	470	970
90	1040	400	540	880
LSD (.05)	N.S.	N.S.	N.S.	N.S.
	Population, plants per acre			
0	18,000	17,000	16,000	12,000
30	16,000	18,000	18,000	12,000
60	17,000	17,000	16,000	11,000
90	17,000	18,000	16,000	14,000

Table 4. Nitrate-nitrogen soil tests for the four locations involved in the nitrogen rate study.

Soil Depth Inches	Location and Cooperator Brown Co. Hanson	Brown Co. Tullis	Spink Co. M. Williams	Spink Co. H. Williams
	NO_5-N, lbs/A			
0-6	30.6	14.4	55.8	54.0
6-12	42.3	7.9	55.8	26.3
12-24	115.0	41.0	248.0	20.9
24-36	59.1	95.4	39.6	7.2
36-48	64.1	14.8	18.0	7.2

Table 5. Yield of four varieties of sunflowers at two populations grown at Redfield, 1974.

Variety	Dryland 17,000	Dryland 22,500	Irrigated 22,500	Irrigated 32,000
	Yield, lbs/A			
Peredovik	488	278	1618	906
Sputnik	360	296	1291	1304
Cargill 101	255	192	1772	1453
Interstate HS-52	647	709	2073	1906
	Actual Population at Harvest plants per acre			
Peredovik	13,000	16,000	15,000	24,000
Sputnik	9,400	14,000	16,000	22,000
Cargill 101	13,000	16,000	17,000	24,000
Interstate HS-52	13,000	18,000	18,000	23,000

Table 6. Yield of three varieties of sunflowers planted at three dates under irrigated conditions at Redfield, 1974.

Variety	Date of Planting May 3	May 17	May 29	Date of Planting May 3	May 17	May 29
	Yield, lbs/A			Plants per acre		
Peredovik	224	870	1370	19,000	19,000	18,000
Issanka	184	458	954	19,000	17,000	16,000
Record	530	1083	1569	17,000	16,000	15,000
LSD (.05)	94					

Table 7. Heading dates for the variety by planting date study.

Variety	Planting Date May 3	May 17	May 29
	Date of 50% flowering		
Peredovik	7/15	7/22	7/26
Issanka	7/11	7/18	7/26
Record	7/21	7/29	8/1

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Agricultural Experiment Station South Dakota State University, Brookings

Red-75-17

Effects of Fertilizers on Yields of Five Spring Wheat Varieties, WALWORTH COUNTY 1974

By R. C. Ward, former research manager, JVREC; Robert W. Pylman, Jr., spring wheat breeder; Paul L. Carson, professor, Plant Science Department; and John L. Skogberg, Walworth County Extension agent.

Summary

Dry weather limited the supply of available moisture to such an extent that the varieties were unable to take advantage of the added soil fertility. Era and Waldron show yields that are slightly higher than the other varieties whether you are comparing the effect of added nitrogen phosphorus or potassium.

Introduction

Variety yield tests in South Dakota and elsewhere have shown the semi-dwarf hard red spring wheats to yield 4 to 5 bushels per acre more than the adapted tall wheat varieties. Since semi-dwarf yield potentials are higher it implies that they will require more plant food elements. The objective of this experiment was to determine differences in the fertilizer requirements of semi-dwarf and tall wheats.

Procedure

This experiment was established on the George and Keith Votja farm southwest of Selby on an agar silty clay loam soil. Agar soils are very dark grayish-brown, deep friable well-drained soils. The field was in small grain in 1973. The seed bed was prepared in the spring. The wheat was seeded April 16. All of the phosphorus and potassium fertilizer was applied in the seed row. All of the nitrogen, except 15 lbs. per acre applied with the seed, was broadcast on the surface May 8. Soil tests on the samples taken at the time of site selection were: Organic matter 2.9% (medium); Phosphorus 25 lbs. of P per acre (medium); Potassium, 990 lbs. of K per acre (very high); pH, 7.5 (slightly alkaline); and nitrates, 96.5 lbs. per acre of NO_3-N in the top 2 feet (high). Harvest was completed July 31st with a small plot combine.

There were 23 fertilizer treatments designed to measure wheat yield response to nitrogen, phosphorus, and potassium fertilizer applications. Rainfall was below normal during the growing season thus reducing the yield possibilities of the wheats. Very little reserve moisture was present in the soil profile at planting time. The low supply of reserve moisture and the below normal rainfall resulted in low wheat yields. Rainfall at Selby for the growing season was: 2.61 inches in April, 4.34 in May, 0.15 in June and 1.13 in July, for a total of 8.43 inches for the growing season. The unfertilized wheat used 5.05 inches of water stored in the soil while the fertilized wheat used 4.89 inches of stored water.

Results and Discussion

Yield results are presented in Tables 1, 2 and 3. The treatments are combined to show response to each element. Table 1 shows the yield of five varieties of spring wheat for five levels of added nitrogen. The average of all five varieties by treatments show no yield increase from the added nitrogen. A yield increase from added nitrogen was not expected because of the large (96 lbs/A) amount of NO_3-N present in the soil at planting time. The effects of the added nitrogen on the yields of the individual varieties was quite errotic and no definite trends in yield can be firmly established. Bounty 208 does seem to show a small increase in yield from added nitrogen while Waldron seems to show a small decrease.

The effects of phosphate fertilizer on yields are illustrated in Table 2. Added phosphorus tended to lower the yield. This held true for all varieties. The soil test for available phosphorus was high enough that a yield increase from added phosphorus was not expected.

The effects of added potassium are shown in Table 3. Era, Bounty 208 and Chris show small yield increases from added potassium. These yield increases may be within experimental error especially in the case of Bounty 208 where the yield increase was small. The soil tests for available potassium are high.

Table 1. Effects of applied nitrogen on yield of five spring wheat varieties grown at Selby, South Dakota, 1974.

Nitrogen lbs/A	Era	WS1809	Bounty 208	Waldron	Chris	Average
0	15.2	12.6	12.8	18.2	14.9	14.7
40	15.5	12.2	13.6	14.5	18.3	14.8
80	17.0	10.8	15.4	14.0	12.2	13.9
120	15.8	13.5	14.3	16.8	13.4	14.8
160	11.5	15.7	15.6	14.7	15.5	14.6
Avg.	15.5	13.0	14.3	15.6	14.9	

Table 2. Effects of applied phosphorus on yields of five spring wheat varieties grown at Selby, South Dakota, 1974.

P_2O_5 lbs/A	Era	WS1809	Bounty 208	Waldron	Chris	Average
0	16.5	13.2	14.4	17.9	15.4	15.5
17	17.6	10.7	14.8	14.2	14.9	14.4
35	14.8	12.5	16.2	13.1	13.1	13.9
52	13.7	14.9	13.9	17.1	16.9	15.3
69	13.5	13.5	12.5	15.9	14.1	13.9
Avg.	15.2	13.0	14.4	15.6	14.9	

Table 3. Effects of applied potassium on yields of five spring wheat varieties grown at Selby, South Dakota, 1974.

K_2O lbs/A	Era	WS1809	Bounty 208	Waldron	Chris	Average
0	14.1	13.3	13.4	17.0	14.2	14.4
6	14.3	13.0	14.5	17.8	16.3	15.2
12	13.9	12.4	15.7	13.6	12.3	13.6
18	17.0	12.7	13.4	13.5	15.5	14.4
24	17.6	13.5	14.0	16.5	16.2	15.7
Avg.	15.4	13.0	14.2	15.6	14.9	

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Effects of Fertilizers on Yields of Five Spring Wheat Varieties, BROWN COUNTY 1974

By R. C. Ward, former research manager, JVREC; Paul L. Carson, professor, Plant Science Department; Robert W. Pylman, Jr., spring wheat breeder, and Marvin W. DeHoogh, Brown County Extension agent.

Summary

Yields were low because of the limited supply of available moisture for the crop throughout most of the growing season, especially during June and July. Bounty 208 consistantly produced the highest average yield irrespective of fertilizer treatment. A yield increase from added nitrogen was not expected because of adequate amount of NO_3-N present in the top 2 feet of soil. Added nitrogen did not increase the yield. A yield increase from added phosphorus was expected because of low phosphorus test values. A yield increase from added phosphorus occurred. Added potassium increased the yield. This was not expected because of the high test for exchangeable potassium.

Introduction

Variety yield tests in South Dakota and elsewhere have shown the semi-dwarf hard red spring wheats to yield 4 to 5 bushels per acre more than the adapted tall wheat varieties. Since semi-dwarf yield potentials are higher, it implies that they will require more plant food elements. The objective of this experiment was to determine differences in the fertilizer requirements of semi-dwarf and tall wheats.

Procedure

This experiment was established on the Howard Schornock farm northwest of Groton on a Beotia silty clay loam soil. Beotia soils are nearly black, deep, friable, silty clay loams occurring on very slight slopes.

The field was in small grain in 1973. The seed bed was prepared by plowing and dragging before planting. The wheat was seeded April 18. All of the phosphorus and potassium fertilizer was applied in the seed row. All of the nitrogen, except 15 lbs. per acre applied with the seed, was broadcast on the surface May 15. Soil tests on the samples taken at the time of site selection were: Organic matter 4.2% (high); Phosphorus, 12 lbs. of P per acre (low); Potassium, 1000 lbs. of K per acre (very high); pH, 7.5 (alkaline); and nitrates, 76.6 lbs. per acre of NO_3-N in the top 2 feet (adequate). Harvest was completed July 29.

There were 23 fertilizer treatments designed to measure wheat yield response to nitrogen, phosphorus, and potassium fertilizer applications. Rainfall was below normal during the growing season thus reducing the yield possibilities of the wheats. Very little reserve moisture was present in soil profile at planting time. The low supply of reserve moisture and the below normal rainfall resulted in low wheat yields. Rainfall at Aberdeen (nearest reporting station) for the growing season was: 1.63 inches in April; 3.70 inches in May; 0.27 inches in June and 1.90 inches in July for a total of 7.50 inches for the growing season. The unfertilized wheat used 5.60 inches of water stored in the soil, while the fertilized wheat used 4.88 inches of stored water.

Results and Discussion

Yields are presented in Tables 1, 2 and 3. The treatments are combined to show response to each element. Table 1 shows the yield of five varieties of spring wheat for five levels of added nitrogen. The average of all five varieties by treatments show no yield increase except at the 120 lbs. per acre rate. Neither the treatment above or below the 120 lb. rate show a yield increase. For this reason the yield increase at the 120 lb. rate appears questionable. The 76.6 lbs. of NO_3-N present in the top 2 feet of soil at planting time should have provided more nitrogen than was needed to produce the yields obtained in 1974. The yields due to nitrogen treatment within each variety are errotic; however, it appears that nitrogen did increase the yield of Chris and WS1809.

The effects of phosphate fertilizer on yields are illustrated in Table 2. Added phosphorus tended to increase the yield. The maximum yield increase from added phosphorus (5 bu/A) was brought about by the lowest rate (17 lbs. of P_2O_5 per acre) of phosphate applied. The largest yield increases from added phosphate were made by Era and WS1809. A

yield increase from added phosphorus was expected because of the relatively low soil test for available phosphorus (12 lbs. of P per acre).

The effects of added potassium on yield are shown in Table 3. The average of all five varieties by treatment shows a yield increase due to added potassium. The largest yield increase was obtained with the smallest (6 lbs. per acre of K_2O) rate of application. A yield increase was not expected because of the large amount (1000 lbs. per acre) of exchangeable potassium found in the soil sample taken at planting time. The addition of potassium made the greatest yield differences with Era (13.3 to 19.2 bu. per acre).

Table 1. Effects of applied nitrogen on yield of five spring wheat varieties grown at Groton, South Dakota, 1974.

Nitrogen lbs/A	Era	WS1809	Bounty 208	Waldron	Chris	Average
0	17.6	16.0	18.3	15.7	14.6	16.4
40	19.7	16.7	17.2	13.7	16.1	16.7
80	14.2	18.5	20.1	15.9	15.2	16.8
120	20.4	19.4	18.7	15.6	16.9	18.2
160	13.3	16.3	15.9	17.0	20.8	16.7
Avg.	17.2	17.4	18.4	15.6	16.7	17.0

Table 2. Effects of applied phosphorus on yields of five spring wheat varieties grown at Groton, South Dakota, 1974.

P_2O_5 lbs/A	Era	WS1809	Bounty 208	Waldron	Chris	Average
0	12.2	12.9	15.6	13.2	12.2	13.2
17	19.2	18.9	18.2	16.0	18.2	18.1
35	14.7	18.1	18.7	16.4	17.7	17.1
52	20.8	17.3	17.6	17.1	14.8	17.5
69	18.2	19.8	17.6	15.3	16.7	17.5
Avg.	17.4	17.4	17.5	15.6	15.6	16.7

Table 3. Effects of applied potassium on yields of five spring wheat varieties grown at Groton, South Dakota, 1974.

K_2O lbs/A	Era	WS1809	Bounty 208	Waldron	Chris	Average
0	13.3	15.6	17.4	14.0	14.3	14.9
6	19.2	18.9	18.3	19.9	18.2	18.9
12	16.2	17.3	18.5	16.4	15.6	16.8
18	22.3	18.2	17.1	18.5	15.4	18.3
24	15.6	17.8	18.3	14.5	17.0	16.6
Avg.	17.3	17.6	17.9	16.7	16.1	17.1

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Effects of Fertilizers on Yields of Five Spring Wheat Varieties, ROBERTS COUNTY 1974

By R. C. Ward, former research manager, JVREC; Robert W. Pylman, Jr., spring wheat breeder; Paul L. Carson, professor, Plant Science Department; and Joe Schuch, Roberts County Extension agent.

Summary

Yields were low because of the limited supply of available moisture for the crop throughout most of the growing season, especially during June and July. Era consistantly produced the highest average yield irrespective of fertilizer treatment. A small yield increase from added nitrogen was obtained in spite of the fact that the amount of NO_3-N in the top 2 feet of soil at planting time appeared to be adequate. A yield increase from added phosphorus was obtained. This yield increase was expected because of the low soil test value for available phosphorus. Added potassium did cause a small yield increase. This yield increase was not expected but the soil test was in a range where added potassium in the row at planting may increase the yield some years.

Introduction

Variety yield tests in South Dakota and elsewhere have shown the semi-dwarf hard red spring wheats to yield 4 to 5 bushels per acre more than the adapted tall wheat varieties. Since semi-dwarf yield potentials are higher it implies that they will require more plant food elements. The objective of this experiment was to determine differences in fertilizers requirements of semi-dwarf and tall wheats.

Procedure

This experiment was established on the Clayton Weeks farm at the Northeast edge of Sisseton on a Fram sandy loam. Fram soils are deep, coarse, loamy soils developed over a strongly calcareous glacial till.

The field was in small grain in 1973. The seed bed was prepared by spring plowing and dragging. The wheat was seeded April 18. All the phosphorus and potassium fertilizer was applied in the seed row. All of the nitrogen, except 15 lbs. per acre applied with the seed, was broadcast on the surface May 15. Soil tests on the samples taken at the time of site selection were: Organic matter, 2.6% (medium to low); Phosphorus, 7.0 lbs. of P per acre (low); Potassium, 303 lbs. of K per acre (medium to high); pH, 8.1 (alkaline); and nitrates, 77.8 lbs. per acre of NO_3-N in the top 2 feet (adequate). Harvest was completed August 5th with a small plot combine.

There were 23 fertilizer treatments designed to measure wheat yield response to nitrogen, phosphorus and potassium fertilizer applications. Rainfall was below normal during the growing season thus reducing the yield possibilities of the wheats. Very little reserve moisture was present in the soil profile at planting time. The low supply of reserve moisture and the below normal rainfall resulted in low wheat yields. The rainfall at Sisseton (nearest reporting station) for the growing season was: April, 1.63 inches; May, 4.14 inches; and June, 0.55 inches for a total of 6.73 inches for the first 3 months of the growing season. July data was unavailable at the time this report was written but it was below normal. The unfertilized wheat used 4.40 inches of the water stored in the soil while the fertilized used 6.28 inches of the stored water.

Results and Discussion

Yield results are presented in Tables 1, 2 and 3. The treatments are combined to show response to each element. Table 1 shows the yield of five varieties of spring wheat for five levels of added nitrogen. The average of all five varieties by treatments show a small yield increase to added nitrogen. The lowest rate of application (40 lbs. per acre) produced as high or higher yields than any of the other rates. A large yield increase from added nitrogen was not expected because of the relatively large amount (77.8 lbs/A) of nitrate-nitrogen in the top 2 feet of soil at planting time. Comparing the yield without added nitrogen and the average of all treatments for each variety, it is evident that the yield of all varieties was increased by added nitrogen. Era produced the highest average yield and Bounty 208 and Waldron had the greatest yield increases from added nitrogen.

The effects of phosphate fertilizers on yields are illustrated in Table 2. Added phosphorus did increase the yield. The yield was increased as the rate of phosphorus application was increased to a maximum of 52 lbs. of P_2O_5 per acre. The greatest

yield increase (4.3 bu. per acre) was obtained with the lowest rate (17 lbs. of P_2O_5 per acre) of phosphate addition. Comparing the yield without added phosphorus and the average for all treatments for each variety, Era again produced the highest yield. Bounty 208 and WS1809 had the greatest yield increases from the added phosphorus, a yield increase from added phosphorus was expected because of the low soil test value for available phosphorus.

The effects of added potassium on yields are shown in Table 3. The average of all five varieties by treatment shows a small yield increase due to added potassium. The largest yield increase was obtained with the smallest (6 lbs. per acre of K_2O) rate of application. The addition of potassium made the greatest yield difference with Era (21.9-24.0 bu/A). The soil test value was on the low end of the high range for available potassium. A small yield increase from a small amount of row applied potassium in some years can be expected.

Table 1. Effects of applied nitrogen on yield of five spring wheat varieties grown at Sisseton, South Dakota, 1974.

Nitrogen lbs/A	Era	WS1809	Bounty 208	Waldron	Chris	Average
0	23.4	20.1	19.5	20.7	18.2	20.4
40	27.3	23.4	33.9	25.0	20.5	26.0
80	26.1	22.6	23.7	23.6	20.7	23.3
120	24.2	24.5	22.7	23.9	22.5	23.6
160	24.2	21.0	22.7	24.2	21.3	22.7
Avg.	25.0	22.3	22.5	23.5	20.6	22.8

Table 2. Effects of applied phosphorus on yields of five spring wheat varieties grown at Sisseton, South Dakota, 1974.

P_2O_5 lbs/A	Era	WS1809	Bounty 208	Waldron	Chris	Average
0	21.2	17.2	17.1	19.7	17.8	18.6
17	24.9	22.5	21.7	24.4	20.7	22.9
35	28.1	23.7	23.8	24.1	20.9	24.1
52	27.2	25.3	24.8	24.6	22.3	24.8
69	21.9	22.8	25.1	24.8	21.6	23.2
Avg.	25.6	22.3	22.5	23.5	20.9	23.0

Table 3. Effects of applied potassium on yields of five spring wheat varieties grown at Sisseton, South Dakota, 1974.

K_2O lbs/A	Era	WS1809	Bounty 208	Waldron	Chris	Average
0	21.9	20.1	21.7	22.3	21.6	21.5
6	20.6	24.3	23.3	24.5	22.3	23.0
12	26.7	22.9	22.5	23.8	20.7	23.3
18	25.8	23.6	23.3	24.5	20.7	23.6
24	25.0	20.7	21.6	22.5	19.4	21.8
Avg.	24.0	22.3	22.5	23.5	20.9	22.6

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Agricultural Experiment Station South Dakota State University, Brookings

Red-75-20

Effects of Fertilizers on Yields of Five Spring Wheat Varieties, CLARK COUNTY 1974

By R. C. Ward, former research manager, JVRED; Robert W. Pylman, Jr., spring wheat breeder; Paul L. Carson, professor, Plant Science Department; and George P. Schanck, Clark County Extension agent.

Summary

Yields were low because of the limited supply of available moisture for the crop throughout the most of the growing season, especially during June and July. Bounty 208 consistantly produced the highest average yield irrespective of fertilizer treatment. Added nitrogen did not increase the yield. A yield increase from added nitrogen was not expected because of the large amount of NO_3-N present in the top 2 feet of soil at planting time. Added phosphorus did increase the yield. This yield increase was expected because of the low test for available phosphorus on the soil from this plot site. Added potassium did produce a small yield increase on some varieties (Era, Chris and Waldron). This yield increase was not expected because of the high exchangeable K soil test.

Introduction

Variety yield tests in South Dakota and elsewhere have shown the semi-dwarf hard red spring wheats to yield 4 to 5 bushels per acre more than the adapted tall wheat varieties. Since semi-dwarf yield potentials are higher, it implies that they will require more plant food elements. The objective of this experiment was to determine differences in the fertilizer requirements of semi-dwarf and tall wheats.

Procedure

This experiment was established on the Lance and Vernon Neuberger farm south of Clark on a Poinsett silt loam soil. Poinsett soils are nearly black, deep, friable, well-drained silt loam soils.

The field was in small grain in 1973. It had been fall plowed. The field was lightly worked before seeding. The wheat was seeded April 15. All of the phosphorus and potassium fertilizer was applied in the seed row. All of the nitrogen, except 15 lbs. per acre applied with the seed, was broadcast on the surface May 17. Soil tests on the samples taken at the time of site selection were: Organic matter, 3.6 (medium); Phosphorus, 12 lbs. of P per acre (low); Potassium, 390 lbs. of K per acre (high); pH, 7.3 (alkaline); and Nitrates, 95 lbs. per acre of NO_3-N in the top 2 feet (high). Harvest was completed July 25.

There were 23 fertilizer treatments designed to measure wheat yield response to nitrogen, phosphorus, and potassium fertilizer applications. Rainfall was below normal during the growing season, thus reducing the yield possibilities of the wheats. Very little reserve moisture was present in the soil profile at planting time. The low supply of reserve moisture and the below normal rainfall resulted in low wheat yields. Rainfall at Bryant (nearest reporting station) for the growing season was: 2.36 inches in April; 4.54 inches in May; 1.74 inches in June; and 1.88 inches in July for a total of 10.52 inches for the growing season.

Results and Discussion

Yield results are presented in Tables 1, 2 and 3. The treatments are combined to show response to each element. Table 1 shows the yield of five varieties of hard red spring wheat for 5 levels of added nitrogen. The average of all five varieties by treatments show no yield increase from added nitrogen. A yield increase from added nitrogen was not expected because of the large amount (95 lbs/A) of NO_3-N found in the top 2 feet of soil at planting time.

The effects of phosphate fertilizer on yields are illustrated in Table 2. Added phosphorus did increase the yield. The largest yield increase (4 bu/A) was caused by the addition of the lowest rate (17 lbs. of P_2O_5 per acre) of fertilizer. Higher rates of fertilizer caused small increases in yield above that received from the 17 lbs. per acre of P_2O_5. A comparison of the check yield with the average for the treatments of each variety shows Era to have the largest (6.0 bu/A) yield increase. A yield increase from added phosphorus was expected because of the low soil test (12 lbs. of P/A) for available phosphorus.

The effects of added potassium on yield are shown in Table 3. The average of all five varieties by treatment shows a yield increase due to added potassium. The largest yield increase (1.6 bu/A) was obtained with the smallest (6 lb. per acre of K_2O) rate of application. A yield increase was not expected because of the large amount (390 lbs. of K/A) of exchangeable potassium found in the soil sample taken at planting time. A comparison of the check yield with the average for the treatments of each variety show Era and Chris to have the largest yield increase (2 bu/A) from the added potassium.

Table 1. Effects of applied nitrogen on yields of five spring wheat varieties grown at Clark, South Dakota, 1974.

Nitrogen lbs/A	Era	WS1809	Bounty 208	Waldron	Chris	Average
0	16.6	21.2	19.2	17.5	18.3	18.6
40	15.8	18.1	19.8	17.3	14.3	17.1
80	15.4	16.7	19.4	20.6	13.7	17.2
120	20.1	19.2	16.6	14.9	13.1	16.9
160	15.5	12.2	16.8	14.6	12.1	14.2
Avg.	15.5	17.5	18.4	17.0	14.3	16.5

Table 2. Effects of applied phosphorus on the yields of five spring wheat varieties grown at Clark, South Dakota, 1974.

P_2O_5 lbs/A	Era	WS1809	Bounty 208	Waldron	Chris	Average
0	9.7	14.1	16.8	12.6	10.3	12.7
17	16.7	18.7	19.9	14.5	13.6	16.7
35	18.7	19.6	18.2	18.4	14.7	17.9
52	19.2	18.7	16.6	17.8	13.9	17.2
69	14.1	18.6	20.8	21.7	14.6	18.0
Avg.	15.7	17.9	18.5	17.0	13.4	16.5

Table 3. Effects of applied potassium on yields of five spring wheat varieties grown at Clark, South Dakota, 1974.

K_2O lbs/A	Era	WS1809	Bounty 208	Waldron	Chris	Average
0	13.3	19.4	18.8	16.9	11.3	15.9
6	19.5	17.5	18.3	17.5	14.7	17.5
12	15.7	18.8	18.4	17.5	15.7	17.2
18	16.3	19.8	18.1	14.7	12.7	16.3
24	13.5	14.0	18.5	18.3	12.6	15.4
Avg.	15.7	17.9	18.4	17.0	13.4	16.5

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PERFORMANCE OF HERBICIDES IN CORN AND SOYBEANS

Red-75-21

W. E. Arnold and L. J. Wrage

Herbicide screening experiments are conducted at the James Valley Agricultural Research and Extension Center at Redfield to give farmers a chance to compare the performance of several herbicides which may be used in their area. The performance of herbicides used on corn and soybeans this year as compared to previous years is presented in the following tables.

Chippewa 64 soybeans were planted in 30-inch rows. Preplant incorporated treatments were applied and incorporated with a tandem disking followed by dragging. The predominant weeds were green and yellow foxtail. The amount of rainfall within 6 days was 0.72 of an inch.

Pioneer 3781 seed corn was planted in 30-inch rows. Preplant incorporated treatments were applied and incorporated with a tandem disking followed by dragging. The predominant weeds were green and yellow foxtail. The amount of rainfall within 6 days was 0.72 of an inch.

All herbicide treatments were applied in a 20 gpa water spray at 40 psi. The planting and spraying information for previous years are reported in the James Valley Agricultural Research and Extension Center Progress Report for the year in question.

Table 1. Corn herbicide demonstrations, Redfield.

Treatment	Rate (lb/A)	% Weed Control 1974 Grass	Broad-leaf*	5-Yr. Avg. Grass	4-Yr. Avg. Broadleaf
PREPLANT INCORPORATED					
atrazine (AAtrex)	2.5	98		96	99
butylate (Sutan)	4	85		84	45
EPTC + R-25788 (Eradicane)	4	96		--	--
butylate + atrazine (Sutan + AAtrex)	3+1	95		91	88
butylate + cyanazine (Sutan + Bladex)	3+2	90		--	--
ethiolate + cyprazine (Prefox)	4+1	93		--	--
PREEMERGENCE					
atrazine (AAtrex)	2.5	75		73	90
alachlor (Lasso)	2.5	90		88	40
propachlor (Ramrod)	5	92		92	38
cyanazine (Bladex)	3[3]	60		74	30
alachlor + atrazine (Lasso + AAtrex)	2+1	92		87	70
alachlor + cyanazine (Lasso + Bladex)	2+1.5	88		74[1]	80[2]

alachlor + dicamba (Lasso + Banvel)	2+½	95		—	—
propachlor + atrazine (Ramrod + AAtrex)	3+1	86		88	70
POST-EMERGENCE					
atrazine + oil (AAtrex)	2+1 gal[4]	40		62	92
cyprazine (Outfox)	3/4	30		48[1]	99[2]
cyanazine (Bladex)	2	10		—	—
Check	—	0		0	0

* No broadleaf weeds present.
[1] Average of two years.
[2] 1973 data.
[3] Previous rate was 2.5.
[4] Previous rate was 1+1.

Table 2. Soybean herbicide demonstrations, Redfield.

		% Weed Control			
Treatment	Rate (lb/A)	1974 Grass	Broad-leaf*	5-Yr. Avg. Grass	4-Yr. Avg. Broadleaf
PREPLANT INCORPORATED					
trifluralin (Treflan)	3/4	98		91	80
vernolate (Vernam)	2.5	85		84	78
dinitramine (Cobex)	0.5	98		89[1]	70[2]
profluralin (Tolban)	3/4	96		—	—
PREPLANT INCORPORATED + PREEMERGENCE					
trifluralin + metribuzin (Treflan + Sencor, Lexone)	3/4+3/8	98		92[1]	80[2]
trifluralin + linuron (Treflan + Lorox)	3/4+1	98		87[1]	70[2]
trifluralin + chlorobromoron (Treflan + Maloran)	3/4+1.5	98		—	—
PREPLANT INCORPORATED + POST-EMERGENCE					
trifluralin + bentazon (Treflan + Basagran)	3/4+3/4	95		—	—
PREEMERGENCE					
chloramben (Amiben)	3	92		86	87
alachlor (Lasso)	2.5	90		86	83
alachlor + linuron (Lasso + Lorox)	2+1	88		86	84
alachlor + metribuzin (Lasso + Sencor, Lexone)	2+3/8	92		86[1]	60[2]
metribuzin (Sencor, Lexone)	0.5	70		65[1]	65[2]
alachlor + chlorbromuron (Lasso + Maloran, Bromex)	2+1.5	90		70[1]	10[2]
chloroxuron (Preforan, Soyex)	3[3]	60		78	72
alachlor + bifenox (Lasso + Modown)	2+1.5	90		—	—
Check	—	0		0	0

* No broadleaf weeds present.
[1] Average of two years.
[2] 1973 data.
[3] Previous rate of 4 lb/A.

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GRAIN SORGHUM AND SOYBEAN RESEARCH

Red-75-22

A. O. Lunden

Early Grain Sorghum Lines and Hybrids

Sorghum breeding research at Redfield in 1974 stressed development and evaluation of early grain sorghum varieties and hybrids. Early maturing grain sorghums can be planted later to reduce the potential hazard of poor field stand from cold soil or cold weather planting. Vigorous seedlings are more resistant to herbicide injury, aid in cultural weed control by being more competitive and are more resistant to insects and diseases. SD 104 and SD 106 are good yielding early lines but as lines they lack the hybrid vigor needed to reach maximum yield potential desired in early grain sorghum. A very promising cytoplasmic male sterile selection of SD 106 is being considered for release. Grain sorghum hybrids from this early male sterile will be extensively tested in 1975.

Plant Grain Sorghum Late for Better Stand and High Yield

All grain sorghum yields were excellent at Redfield in 1974 although the "early" planting (about May 20-22) was delayed by rain and was not made until May 29. Plant stands and weed control were both excellent for this date of planting. Even at this delayed planting date the best hybrid produced 120 bushels per acre in spite of early frost and cool weather in September and early varieties ranged to nearly 90 bushels per acre. Early varieties in the "late" planting, delayed by rain until June 14, yielded about 15% less than the earlier planting and a further delay to June 27 averaged only 30 bushels per acre. Planting in late May was best for late maturing hybrids as well as for early entries in both 1973 and 1974.

Dryland Grain Sorghum and Narrow-Row Planting

Early sorghum varieties SD 104 and SD 106 averaged 44 bushels per acre when planted June 14 without irrigation in 1974 but only 14 bushels per acre when planted on June 27. This compares to 72 and 26 for the same dates with supplemental water. Seed quality was good for the mid-June planting but very poor from planting in late June. Narrow-row spacing was not beneficial as yields were not increased and lodging was more severe than in wide rows.

Soybean Variety Testing

Soybean yields were well below 3-year and 5-year averages at Redfield in 1974. Early varieties were generally favored because of the short growing seaaon but Wells, Corsoy and Steele are still the highest yielding standard varieties based on 3 years of yield tests. Several commercial entries are statistically equivalent to these entries on the basis of the last 3 years of testing. Data are presented in Table 1.

Table 1. Soybean yields, 1972-74, Redfield.

Variety	Relative # of days to mature	Yield (bu/A) 1974	1973	1972-74	Plant ht. 1974 (in.)	Lodging 1974 (%)
Wells	+10	21.9	25.2	29.6	42	1
Corsoy	+10	26.5	24.3	28.5	41	30
Steele	+ 4	28.3	25.2	28.3	38	20
Chippewa 64	+ 3	23.0	17.5	23.2	36	4
Amsoy 71	+14	15.9	18.4	19.0	44	6
Evans	- 4	28.8	—	—	35	5
Swift	- 2	25.3	—	—	35	15
Hodgson	+ 3	28.0	—	—	37	2
Agripro-1120	+ 3	26.7	20.7	26.3	33	1
Agripro-1235	+ 4	26.1	20.1	—	33	7
Agripro-14	+ 8	25.0	—	—	38	2
Cherokee II	+ 8	20.1	—	—	40	10
Felco G044	+ 3	23.3	—	—	42	40
Felco G045	+ 4	24.5	20.0	26.4	37	5
Felco Pike	+ 4	28.5	23.2	—	33	4
McCurdy 90+	+10	23.0	—	—	41	15
Riverside 303	+ 4	29.4	—	—	43	10
Riverside 304	+ 6	25.4	—	—	42	25
SRF 100	+ 3	17.8	22.9	21.6	47	12
SRF 150	+ 6	24.2	19.2	24.2	41	12
LSD	---	3.6	N.S.	2.8	--	--

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Red-75-23

ACID-TREATED VS. DRIED CORN WITH AND WITHOUT ZERANOL IMPLANTS FOR FINISHING CATTLE

By L.B. Embry, professor, Animal Science Department, and R.C. Ward, former research manager, JVREC.

Summary

Propionic acid at a rate of 15 lb. per ton of corn grain with about 22% moisture appeared to be effective in preserving the corn over a period of slightly over 1 year. Differences in weight gain were small but steers fed acid-treated corn required 8.7% more corn dry matter per 100 lb. of gain.

Implanting steers of about 650 lb. initial weight with 36-mg zeranol resulted in an improved weight gain (10.2%) and feed efficiency (8.4%) over the 158-day experiment.

Introduction

Corn grain is frequently harvested at a moisture content too high for safe keeping under conventional grain storage conditions. While this may be a desirable, or necessary, practice, the grain must be dried, stored so as to produce ensiled grain or treated with an effective preserver to prevent spoilage during storage. Each of these methods is being used for preservation and storage of corn when harvested at a high-moisture (20-30%) content and used for feeding livestock. Total costs including storage structures, losses in the processes and storage, and comparative feeding value are factors to consider in choice of method for grain to be fed to livestock.

Several previous experiments have shown that corn grain in the order of 25 to 30% moisture results in weight gain and feed efficiency equal to or slightly better than from corn dried to a moisture content for safe keeping under conventional storage conditions. More research has been conducted with untreated grain stored under various conditions than with grain treated with a preservative. Recently there has been considerable interest in treating high-moisture grains as a means of safe keeping for later feeding. Organic acids--primarily propionic or a mixture of propionic and acetic--have been shown to be effective for this purpose.

In the experiment reported here, cattle were fed high-grain finishing rations with corn grain harvested at a high moisture and dried or treated with propionic acid. The grain treatments were tested with cattle with and without a 36-mg zeranol implant at the beginning of the experiment.

Procedure

Twenty-four Hereford x Angus and 36 Hereford steers were purchased for the experiment. For a period of 1 to 2 weeks prior to the experiment, they were fed about 5 lb. per head daily of corn grain and a full feed of alfalfa-brome hay.

The steers were allotted into 4 pens of 15 each on basis of weight and breed group for two dietary treatments. Two pens of steers were fed corn grain which had been dried by a local elevator. The other two pens were fed corn grain which was treated with propionic acid by a commercial applicator. Each kind of corn grain was fed to appetite in the whole form along with chopped alfalfa hay. The hay was fed at 4 lb. per head daily at the beginning of the experiment. The steers would not consume the 4 lb. of hay daily when offered corn grain in amounts so some remained in the feed bunks at the next feeding. The daily level was reduced to 3 lb. This lower level was consumed and was continued throughout the remainder of the experiment. The rations were considered to furnish an adequate amount of protein for cattle of the weight in the experiment. Therefore, no supplement was fed except for trace mineral salt and dicalcium phosphate offered on a free-access basis.

About 2000 bu. of wet corn was treated with propionic acid and stored in an enclosed wooden corn crib. The moisture content was about 22% at harvest. The acid was added at a rate of 15 lb. per ton of wet grain (0.75%). Storage was for about 8 months prior to beginning of the experiment. A similar quantity of corn was dried at a local elevator. However, the corn received from the elevator was not

the same as that delivered. The dried corn was stored in steel bins.

At the beginning of the experiment, the steers in one of the pens from each grain treatment group were implanted with 36-mg zeranol.

Results

The cattle were fed for a period of 189 days before marketing. The rations of 3 lb. chopped alfalfa hay and a full feed of corn grain were considered to contain an adequate amount of protein for cattle of the weight as in this experiment. Other research would support this assumption. Therefore, no supplements were offered except for free access to trace mineral salt and dicalcium phosphate.

Upon termination of the experiment, some cattle showed signs of vitamin A deficiency. Weight gains during the last month were somewhat low and rather erratic in comparison to performance on previous weight days. It was considered that performance at 158 days might more typically represent comparative effects of treatments. Therefore, the data have been summarized on basis of weight and feed data for the experiment after 158 days.

Acid-treated vs. Dried Corn

Results of the experiment showing performance obtained from corn grain harvested at about 22% moisture and treated with propionic acid at 15 lb. per ton of moist grain and from dried grain are shown in Table 1. There were only small differences in rate of gain between the two treatment groups. Those fed the corn treated with 15 lb. of propionic acid per ton of moist grain consumed more corn.

The average dry matter content of the acid-treated grain as fed was 80% as determined by over drying. This represented an increase of 2 percentage units from the dry matter content when harvested. This small loss of moisture might be expected over the period of about 8 months from harvest to beginning of the experiment and during the experiment of slightly over 5 months. The grain appeared to keep well during storage as evidenced by retention of color and the acid odor during storage.

The dried grain had an average dry matter content as fed of 86%. On basis of the dry matter contents as fed, the cattle fed the acid-treated corn required 8.7% more corn dry matter per 100 lb. of gain. Since the amount of hay was fed at equal rates to both groups of steers and there were only small differences in rates of gain, the difference in feed requirements between corn treatment groups was largely that of the corn grains.

Zeranol

Results of the experiment showing effects of the implant treatment are also shown in Table 1. Rate of gain for steers implanted with 36-mg zeranol exceeded that for implant controls by 0.25 lb. daily (10.2%) over the 158 days. The implanted steers consumed more corn daily but had lower feed requirements (8.4% less than implant controls).

Table 1. Corn preservation and implant treatments for finishing cattle (June 10 to Nov. 15, 1974--158 days).

	Corn treatment		Implant treatment	
	Acid-treated	Dried	Control	Zeranol (36 mg)
No. of animals	29	29	29	29
Init. filled wt., lb.	648	650	651	647
Final filled wt., lb.	1058	1051	1037	1073
Avg. daily gain, lb.	2.60	2.54	2.44	2.69
Avg. daily feed, lb.				
Corn				
As fed	21.98	18.36	20.06	20.28
Dry	17.58	16.47		
Alfalfa hay	3.39	3.40	3.40	3.39
Feed/100 lb. gain, lb.				
Corn				
As fed	845	723	822	754
Dry	676	622		
Alfalfa hay	130	135	139	126

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PLOWING VS. DISKING FOR CORN AND TIMING OF IRRIGATION AFTER FURROWING

Red-75-24

Raymond C. Ward and Robert A. Sanders

Summary

Corn yields were higher on ground that had been plowed before preparing the seed bed than on ground that had been tandem disked only. The heavy trash of the previous corn crop appeared to be the reason the corn yields were lower on the disked plots. Delayed irrigation after furrowing did not reduce corn yields.

Introduction

This experiment was conducted to compare the yield of corn on land that was plowed and disked to that on land that was tandem disked only. The plowing operation is the most expensive tillage operation. If plowing could be eliminated it would help reduce the cost of production.

Another objective of the study was to determine the potential yield loss by delaying irrigation after hilling. Hilling does a lot of root pruning, which could reduce yields if the soil was not wet so new corn roots could grow.

Procedure

The land was corn in 1973 which was harvested for grain. The field was tandem disked after harvest without chopping stalks. Spring tillage was as follows:

Plow Plot	Disk Plot
Plow May 2	Disk May 3
Disk May 3	Disk May 26
Disk May 26	Harrow May 27 (2X)
Harrow May 27 (2X)	

Jacques JX 62 hybrid corn was planted May 27 in 30 inch rows. Twelve gallons of 7-21-7 with 1 qt. of Nulex Zinc was applied as a starter. Dyfonate insecticide was banded over the row at 5 lbs. per acre. Lasso at 2½ quarts per acre was broadcast May 29. Nitrogen was applied as anhydrous ammonia at 150 lbs. actual N per acre. Three irrigations of 4.5 inches/set were applied. Hand harvested yields were taken the first week of October.

Results and Discussion

Yield, ear corn moisture, and plant population are shown in Table 1. The plow treatment produced 11 bushels more than the disk treatment. There were no differences in moisture or population between the two treatments.

The corn plants appeared more vigorous on the plowed plots early in the season. These plants were able to produce more yield. In 1973 the opposite effect occurred when corn was planted deeper on the plowed plot.

The residue left by the disking operations is a disadvantage. The double disk shoes could not penetrate the heavy residue therefore planting depth was not uniform. A planter shoe that moves the trash away from the row should be used to get a uniform stand.

The study of irrigation after furrowing showed that yields were slightly better when irrigation was delayed after hilling. Hilling or furrowing prunes many corn roots. The 1.5 inches of rainfall received 2 days after hilling explains why there was no benefit from irrigation the same day the hilling was done.

Table 1. Effects of tillage and irrigation timing on yield, moisture content, and population of corn.

Tillage Treatment	Irrigation After Furrowing	Yield Bu/A	Moisture %	Population Plants/acre
Disk-Disk-Disk	same day	89	34.2	18,600
	7 days later	93	32.0	19,300
	14 days later	102	29.1	19,300
	mean	95	31.7	19,100
Disk	same day	105	30.8	18,900
Plow-Disk-Disk	7 days later	104	29.2	19,800
	14 days later	108	28.6	20,000
	mean	106	29.5	19,500
LSD (.05)	for tillage	9	ns	ns
Coefficient of variation		6.4%	7.2%	4.7%

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Agricultural Experiment Station South Dakota State University, Brookings

ZINC RATE EXPERIMENT

Red-75-25

Raymond C. Ward and Robert A. Sanders

Summary

No corn yield increase was obtained from rates of zinc applied in 1973.

Introduction

In 1973 zinc deficiency symptoms were noted in corn grown on field 1. Several zinc rates were broadcast and plowed under in 1973. Corn was grown in 1973 and again in 1974 to determine effects of zinc on the yield of corn.

Procedure

Corn stalk land was tandem disked twice the last week of April. Before planting on May 29 the field was field cultivated. Sokota MS-59 was planted in 30 inch rows. Dyfonate insecticide (@ 5 lbs/acre) was applied. Anhydrous ammonia at 150 lbs actual N was applied June 15th. A broadcast rate of Lasso (2.5 qts/acre) was applied after planting. The corn was cultivated twice. The crop was furrow irrigated four times receiving about 2.5 inches per application. Yield samples were hand harvested the first week of October.

Results and Discussion

Yield and moisture content of ear corn and the plant population are shown in Table 1. Zinc rates did not statistically increase yield, affect moisture, or change plant population.

Zinc deficiency usually occurs in seasons when soil temperatures are below normal and soil moisture high. In 1974 temperatures were warm and soil moisture low, thus alleviating the zinc deficiency.

Table 1. Effects of zinc rates on corn yield, ear moisture, and plant population, 1974.

Zinc Rate lbs Zn/A	Yield Bu/A	Moisture %	Plants/Acre
0	106	40.0	20,100
5	103	38.2	19,300
10	104	40.4	20,400
20	108	37.5	21,000
LSD (.05)	ns	ns	ns
Coefficient of variation	5.2%	26.7%	5.5%

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RESPONSE OF SMALL GRAIN VARIETIES TO IRRIGATION

Red-75-26

Raymond C. Ward and Robert A. Sanders

Summary

Wheat varieties responded to an application of 3 inches of water just after heading. The average response was 10 bushels per acre. Some varieties responded more to the water than others. Oat and barley varieties showed little response to the June 24th application of 3 inches of water.

Introduction

Can an irrigator water small grains economically? This question is asked often. We know some varieties have greater yield potentials and perhaps they may be suitable for irrigation. The purpose of this report is to measure response of several small grain varieties to irrigation.

Procedure

Wheat, oats, and barley were planted on land that was in small grain in 1973. The varieties were planted April 19 after tandem disking and harrowing the ground. The land had been tandem disked twice in September 1973. No fertilizer was applied because soil tests were very high (from past manure applications). The crops were sprayed with MCP in late May for weed control. Yields were taken with a small self-propelled combine.

The plots were irrigated (tow-line) June 24. An earlier application was not applied because of other sprinkler equipment being installed prior to June 24. Three inches of water were applied.

Results and Discussion

Water was applied too late to receive the greatest benefit. Generally, small grain should be irrigated when it is tillering, and when it is heading. Wheat headed between June 18 and 25; barley June 11-18; and oats June 19-July 1.

Wheat variety yields are shown in Table 1. Irrigation (3 inches) produced a 10 bushel per acre response when averaged for all varieties. All varieties responded to the irrigation. The varieties responding by 12 bushels or more were Hercules, Protor, Rugby, Olaf, Nowesta and WS 1809.

Waldron and MP-190 were the highest yielders when irrigated, while Waldron and Rollette were the highest yielders for dryland.

Oat varieties did not respond to irrigation (Table 2), although heading dates were similar. The overall response to irrigation was only 3.6 bushels per acre. Chief, Froker, and SD-955 were the highest yielding varieties for both dryland and irrigated conditions.

Barley yields are shown in Table 3. Primus II and Cree showed opposite differences in response. The irrigation application was probably too late to be of benefit to the barley.

Table 1. Effect of irrigation on yield of several wheat varieties, 1974.

Variety	Yield (Bu/A) Irrigated	Dryland
Nordak	20.5	14.4
Crosby	34.7	24.0
Ward	32.9	24.4
Botno	34.9	27.3
Ellar	34.6	28.2
Rollette	40.9	32.1
WS-3	34.9	25.1
Bonanza	35.4	24.7
Hercules	31.2	18.7
Tioga	34.0	23.8
Protor	40.7	28.0
WS-6	31.4	19.6
Rugby	38.1	23.6
Olaf	40.9	24.2
Nowesta	37.2	22.2
Polk	35.1	27.1
MP-19D	42.1	30.9
Leeds	38.9	29.6
Chris	25.8	15.6
Prodax	29.1	17.8
Sheridan	30.7	26.0
Bounty 208	33.2	27.4
WS-1809	40.3	26.7
Era	32.9	22.4
Waldron	42.5	34.7
Minn. II-64-33	34.9	26.9
Average	34.9	24.8
LSD (.05) for varieties	3.3 bu/A	
LSD (.05) for irrigation	0.5 bu/A	
Coefficient of variation	10.8%	

Table 2. Effect of irrigation on yield of several oat varieties, 1974.

Variety	Yield (Bu/A) Irrigated	Dryland
Garland	58.6	63.1
Grundy	63.7	60.3
Noble	61.0	54.5
Kelsey	44.0	52.1
Burnett	60.3	51.4
Trio	50.4	48.0
Holden	50.4	42.6
Cayuse	64.4	53.5
Nodaway-70	72.9	63.7
Multitine M-73	53.8	50.1
Portal	63.4	57.9
Otee	62.7	55.2
Multiline E-74	63.0	52.8
Astro	52.8	42.3
Diana	68.5	73.6
SD-955	78.7	75.3
Chief	77.0	77.3
Froker	73.3	78.0
Dal	68.8	67.1
Average	62.5	58.9
LSD (.05) for varieties	7.1 bu/A	
LSD (.05) for irrigation	2.3 bu/A	
Coefficient of variation	11.5%	

Table 3. Effect of irrigation on yield of several barley varieties, 1974.

Variety	Yield (Bu/A) Irrigated	Dryland
Manker	47.9	47.9
Primus II	53.2	44.1
Beacon	45.9	45.9
Cree	32.5	41.3
Larker	38.2	39.8
Prilar	42.7	41.8
Average	43.4	43.4
LSD (.05) for varieties	ns	
LSD (.05) for irrigation	ns	
Coefficient of variation	12.4%	

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SOYBEAN AND DRY BEAN TESTING

Red-75-27

R. C. Ward, R. A. Sanders and John Skogberg

Summary

Soybean yields were very low this year. The variety performance trial at Selby showed that Hodgson may be a better variety under dry conditions. The low yields show that more study is needed to determine the feasibility of growing beans in the drier areas of South Dakota. Dry bean yields were low under dryland and sprinkle irrigated conditions. It appeared that disease limited yields under both conditions.

Introduction

The relatively high prices paid for soybeans and dry beans at times has generated interest in growing these crops in north central South Dakota. The objective of these studies was to measure variety performance of soybeans and dry beans in this area of South Dakota.

Procedures

James Valley Agricultural Research and Extension Center--Soybeans were planted in 30 inch rows on corn silage ground that was tandem disked in early May and then field cultivated twice before planting June 3. No fertilizer was used. Lasso II granules were used at label rate. The beans were cultivated twice and hand harvested the last week of September.

The navy beans were planted June 2 on wheat stubble land that had been tandem disked, sprayed with 1½ quarts of treflan, and then tandem disked twice immediately to incorporate. They were cultivated once. They were sprinkle irrigated twice with about 3 inches of water for each application. Harvest was completed by hand.

Walworth County--Soybeans and dry beans were planted in 38 inch rows on May 26 (too early, no sprouting for 2½ weeks) on summer fallowed land southwest of Selby. Several herbicides were applied to control weeds and the crops were cultivated once. Hand harvested samples were taken the third week of September.

Results and Discussions

The yields of soybeans at the two locations are shown in Table 1. The extremely dry weather encountered at both locations reduced yield potential of soybeans. There appeared to be no difference in yield at Redfield but Hodgson was 3 to 4 bushels per acre better at the Walworth County location. The low yields make it questionable whether to grow soybeans under dryland conditions in north central South Dakota.

The performance of several dry bean varieties is shown in Table 2. The yields at Redfield were very disappointing. There was considerable blight which reduced yield considerably. The disease could have been seed borne and spread by the sprinkle irrigation, because in another yield test that was furrow irrigated yields were much better.

Drybean yields at the Walworth County location were poor because of the drought. Disease was also a problem. Apparently seed borne disease is a problem and growers must know where seed was grown so that disease problems can be avoided. The disease problem also points out the importance of using good rotations when growing "speciality" crops.

Table 1. Yields of several soybean varieties grown at Redfield and Walworth County, 1974.

Variety	Yield (Bu/A) Redfield	Walworth Co.
Corsoy	8.5	9.2
Swift	9.1	8.2
Chippewa 64	8.5	8.5
Hodgson		12.1
SRF 100		7.8
Wells	7.6	

Table 2. Yield of several dry bean varieties grown at the Walworth County or Redfield locations, 1974.

Variety	Yield (lbs/A) Redfield	Walworth Co.
Snowflake	460	
Sanilac	650	
Snow Bunting	470	
Seafarer	480	
Great Northern 59		385
Seafarer (certified)		473
Seafarer (registered)		85
Sanilac (certified)		63
Sanilac (registered)		101
Idaho 111 (grade) Pinto		330
Idaho 111 (certified) Pinto		216
Pink (certified)		178

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Red-75-28

EFFECTS OF PLANTING DATE, POPULATION, AND HYBRID ON YIELD OF IRRIGATED CORN

Raymond C. Ward and Robert A. Sanders

Summary

Corn yields were reduced about 17 bushels per acre by delaying planting from May 6 to June 2. Moisture content was about 12% higher when planting was delayed.

Populations of about 22,000 plants per acre produced the highest yields. Planting rate did not affect moisture content of the ear corn.

Silage yields were similar for all hybrids, planting dates, and populations.

Introduction

The purpose of this study was to measure the effects of planting rate and planting date on the yield of seven corn hybrids.

Procedure

Corn was planted on irrigated corn ground. Tillage operations included stalk chopping, tandem disking three times, and field cultivating once (on the June 2 planting). Corn was planted in 30 inch rows.

Starter fertilizer was used at the rate of 12 gallons of 7-21-7 with 1 quart of Nulex Zinc. Anhydrous ammonia was sidedressed at 40 lbs of actual N per acre (according to nitrate soil tests). Furadan was applied to control corn root worm and atrazine was applied preplant incorporated to control annual weeds.

The corn was irrigated three times with each application putting on 3-4 inches of water. Silage yields were taken the first week of October and ear corn yields the middle of October.

Results and Discussion

Seven hybrids were planted at two populations and two dates as shown in Tables 1-6. The populations (seeding rates) were (1) 22,500 and (2) 28,000.

Ear corn yields are shown in Table 1. The highest yielding hybrids for the May 6 planting were Sokota TS67 (120.2 bu/acre), ACCO 1900 (118.9 bu/acre), and Trojan TXS102 (118.4 bu/acre). The same hybrids were the highest yielding at the June 2 planting but were 13 to 25 bushels lower in yield. The higher planting rate produced 6 to 7 more bushels per acre, on the average. Although the hybrid by population interaction was not statistically significant there were trends for hybrids to react differently when planted at different rates. Trojan TXS102 yields increased from 106.7 to 130.1 bu/acre when planted thicker (May 6 planting). Sokota TS67 and Trojan TXS 94 yields decrease when planted thicker (May 6 planting). The hybrid reactions were different at the June 2 planting.

Ear corn moisture is shown in Table 2. DeKalb XL10 and Pioneer 3932A produced the driest corn when planted May 6 (16.1% moisture). At the June 2 planting DeKalb XL10 and ACCO 1900 were the driest and contained 22.0% moisture and 26.5% moisture, respectively. Planting rate did not change moisture significantly. A 4 week delay in planting increased moisture content 11 to 12%. The greatest effect of delayed planting on ear moisture occurred with Pioneer 3932A (16.1 vs 37.7% moisture). ACCO 1900 and DeKalb XL10 showed the smallest increase in moisture content with delayed planting.

The number of ears and stalks are shown respectively in Tables 3 and 4.

The yield of silage for each hybrid at two planting dates for two populations is shown in Table 5. There were no significant differences in yields from any of the factors studied. It shows that a yield of about 16 tons of 65% moisture silage was produced. This can be compared to yields in the four ton range for dryland silage (Table 7).

The moisture content of the corn when cut for silage (Table 6) shows that earlier maturing hybrids would make better quality silage, especially when planted late.

Table 1. Effect of hybrid, population and planting date on yield of ear corn, 1974.*

Hybrid	May 6 Pop I	May 6 Pop II	May 6 Average	June 2 Pop I	June 2 Pop II	June 2 Average	AVERAGE
	Yield, Bushels per Acre						
Pioneer 3780	105.6	114.3	109.9	82.9	88.5	85.7	97.8
Sokota TS67	122.7	117.6	120.2	100.5	113.4	107.0	113.6
DeKalb XL10	99.2	102.2	100.7	79.4	93.2	86.3	93.5
Trojan TXS102	106.7	130.1	118.4	98.1	104.7	101.3	109.9
ACCO 1900	111.8	125.9	118.9	88.6	96.4	92.5	105.7
Pioneer 3932A	108.0	119.0	113.5	92.7	90.5	91.6	102.6
Trojan TXS94	97.3	93.1	95.2	92.6	88.4	90.5	92.9
Average	107.3	114.6		90.7	96.4		

LSD (.05) for hybrids = 10.7; for pop. 5.7; for date 5.7.
Coefficient of variation 12.8%

* Yield corrected to 15.5% moisture.

Table 2. Effect of hybrid, population and planting date on moisture content of ear corn, 1974.

Hybrid	May 6 Pop I	May 6 Pop II	May 6 Average	June 2 Pop I	June 2 Pop II	June 2 Average	AVERAGE
	Yield, Bushels per Acre						
Pioneer 3780	24.7	22.1	23.4	35.5	36.7	36.1	29.8
Sokota TS67	25.5	28.0	26.7	38.9	41.2	40.1	33.4
DeKalb XL10	16.0	16.2	16.1	21.7	22.4	22.0	19.1
Trojan TXS102	26.8	24.0	25.4	38.4	38.7	38.6	32.0
ACCO 1900	19.3	19.0	19.2	27.2	25.9	26.5	22.9
Pioneer 3932A	16.1	16.0	16.1	36.3	37.0	37.7	26.9
Trojan TXS94	22.4	20.2	21.3	27.7	33.6	30.6	25.9
Average	21.6	20.8		32.2	33.9		

LSD (.05) for hybrid=2.0%; for date 1.1; for hybrid x date 2.8; for pop x date 1.4.
Coefficient of variation 8.9%.

Table 3. Number of ears per acre from seven hybrids planted at two rates on two dates.

Hybrid	May 6 Pop I	May 6 Pop II	June 2 Pop I	June 2 Pop II
	Number of corn ears per acre			
Pioneer 3780	20,880	23,925	16,965	20,735
Sokota TS67	18,705	20,590	16,820	20,735
DeKalb XL10	20,880	21,170	17,545	23,055
Trojan TXS102	17,400	19,865	16,530	21,025
ACCO 1900	19,865	21,460	16,385	18,705
Pioneer 3932A	18,850	21,170	18,415	19,430
Trojan TXS94	17,835	19,285	18,415	22,620

Coefficient of variation = 10.2%

Table 4. Number of corn stalks as affected by hybrid, planting population and planting date.

Hybrid	May 6 Pop I	May 6 Pop II	June 2 Pop I	June 2 Pop II
	Number of stalks per acre			
Pioneer 3780	20,590	24,070	17,400	20,880
Sokota TS67	22,475	22,910	18,125	23,490
DeKalb XL10	22,475	24,215	17,400	23,345
Trojan TXS102	19,720	20,590	17,690	22,620
ACCO 1900	21,460	22,910	17,255	19,285
Pioneer 3932A	18,995	22,330	18,560	20,590
Trojan TXS94	18,415	20,300	19,140	22,765

Coefficient of variation = 9.5%

Table 5. Yield of silage from seven hybrids planted at two populations at two dates, 1974.*

Hybrid	May 6 Pop I	May 6 Pop II	May 6 Average	June 2 Pop I	June 2 Pop II	June 2 Average	AVERAGE
	Yield, Tons/Acre (65% moisture)						
Pioneer 3780	14.4	17.6	16.0	15.3	17.1	16.2	16.1
Sokota TS67	15.3	17.8	16.5	17.0	17.7	17.3	16.9
DeKalb XL10	16.4	14.3	15.4	15.2	13.7	14.4	14.9
Trojan TXS102	16.3	16.5	16.4	17.0	17.5	17.2	16.8
ACCO 1900	16.6	14.5	15.5	16.8	17.4	17.1	16.3
Pioneer 3932A	16.6	17.6	17.1	16.9	16.3	16.6	16.9
Trojan TXS94	13.4	16.2	14.8	15.6	16.2	15.9	15.3
Average	15.6	16.2		16.3	16.5		
LSD (.05)	ns	ns		ns	ns		

Coefficient of variation 12.2%

* Yield corrected to 65% moisture.

Table 6. Moisture content of silage as harvested.

Hybrid	May 6 Pop I	May 6 Pop II	May 6 Average	June 2 Pop I	June 2 Pop II	June 2 Average	AVERAGE
	% moisture as harvested						
Pioneer 3780	71.5	66.1	68.8	70.9	70.6	70.7	69.7
Sokota TS67	69.1	64.8	66.9	72.0	71.6	71.8	69.3
DeKalb XL10	61.9	67.4	64.6	69.2	73.5	71.3	68.0
Trojan TXS102	68.0	71.0	69.5	69.0	70.8	69.9	69.7
ACCO 1900	63.4	67.1	65.2	68.4	66.9	67.6	66.4
Pioneer 3932A	65.1	65.6	65.4	71.9	72.6	72.2	68.8
Trojan TXS94	69.2	68.6	68.9	69.6	69.3	69.4	69.1
Average	66.8	70.1		67.2	70.7		

LSD (.05) for date = 2.2%
Coefficient of variation 5.9%

Table 7. Yield of four hybrids under dryland conditions at Redfield, 1974.

Hybrid	Silage Yield* Tons/Acre	Percent Moisture
Sokota TS46	3.6	75.6
Jacques JX62	4.3	72.1
Pioneer 3780	3.9	76.2
DeKalb XL10	3.7	77.3

* Yield corrected to 65% moisture.

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SOLAR HEAT FOR DRYING SHELLED CORN

Red-75-29

William H. Peterson and Mylo A. Hellickson

Conventional drying methods often require more petroleum fuel to dry a corn crop than to raise and harvest it. Increasing prices and threatening scarcity of petroleum fuels make it worthwhile to investigate methods of drying that do not require the use of petroleum fuels.

Five different types of solar heat collectors (see Figure 1) were fitted to the southern two-thirds of the wall of a 14-foot diameter steel bin used to dry shelled corn. A 3 hp fan and 8000-watt heater were used, along with a standard perforated steel drying floor.

During the drying period, the fan was operated continuously, and the heater was operated by time-clock from midnight to 6 a.m., the time when relative humidity is usually highest.

Temperatures were automatically recorded at 23 locations, including inlets and outlets of solar collector sections and fan and heater. Airflow measurements were made periodically. This information was used to determine the amount of heat provided by the solar collectors, by the fan and heater, and the heat utilized by the shelled corn for evaporation of moisture. Electrical energy inputs were recorded by standard Kilowatt-hour meters.

Figure 2 shows the cumulative amounts of heat provided by different means along with the water removed (as determined from moisture content samplings) and the heat utilized by the corn for evaporation of moisture. The solar collectors provided 34 percent of the total energy.

Figure 3 shows comparisons of the average hourly heat input from each of the different types of solar collectors, along with solar radiation recorded at the site. Collector "E", located at the bottom of the bin shows somewhat higher amounts of heat collected, particularly at night. This may be partly explained by the fact that it was located next to the space beneath the perforated floor, which was 11 degrees warmer than the outdoor temperature from midnight to 6 a.m. because of use of electric heat, and up to 10 degrees warmer during the day because of heat from the solar collectors.

The bare, corrugated sheet metal collectors, appeared to be, for practical purposes, as efficient as the plastic-covered collectors, and promise a longer life with less maintenance than the plastic-covered collectors.

Table 1 gives a summary of the results of the drying operation in the fall of 1974.

Table 1. Summary of Results, Solar Drying, Redfield.

Drying period: October 24-November 5		
Average initial moisture, shelled corn		22.17 percent
Average final moisture, shelled corn		15.3 percent
Moisture removed:		6.87 points
Bushels: 1000 bushels		
Kilowatt-hours, fan:	944	
Kilowatt-hours, heater	952	
Kilowatt-hours, total	1,896	
Kilowatt-hours per bu.	1.896	
Kilowatt-hours per bushel per point:	0.275	

Acknowledgement is given to the National Science Foundation for financial support of this research through the Agricultural Research Service of USDA and the Agricultural Experiment Station, SDSU. A contribution for construction of the solar collectors, was made by the East River Electric Power Cooperative, Madison, South Dakota and labor for the electrical installation was supplied by Spink Electric Cooperative, Redfield.

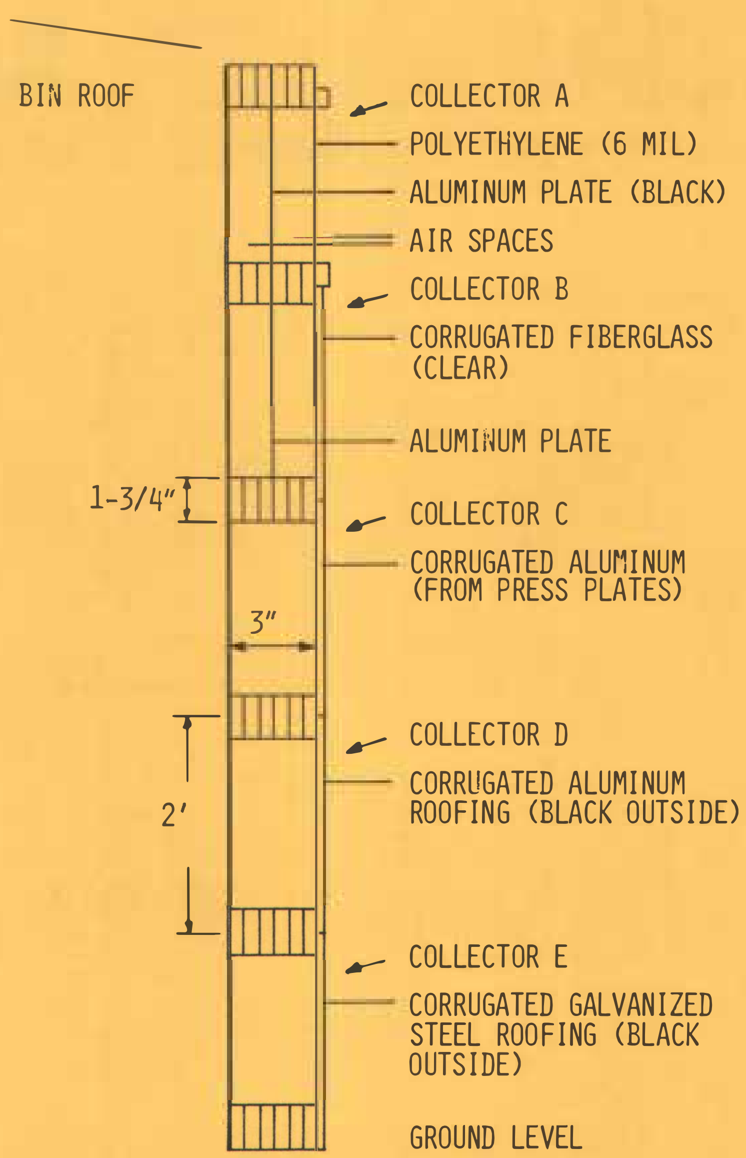

FIGURE 1 - CROSSECTION OF FIVE TYPES OF SOLAR COLLECTOR

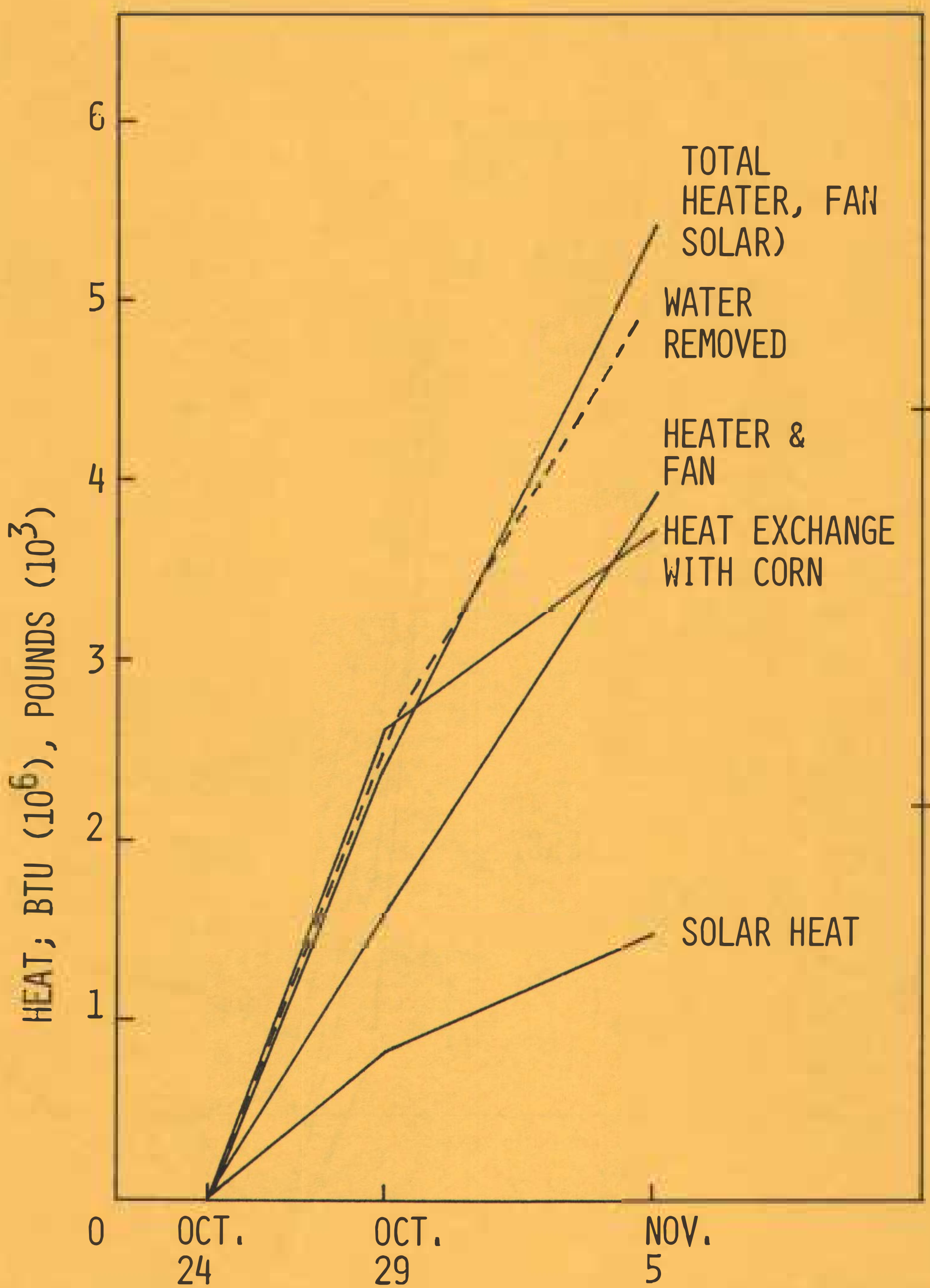

FIGURE 2. - CUMULATIVE AMOUNTS OF HEAT SUPPLIED AND UTILIZED, AND WATER REMOVED FROM SHELLED CORN DURING THE DRYING PERIOD.

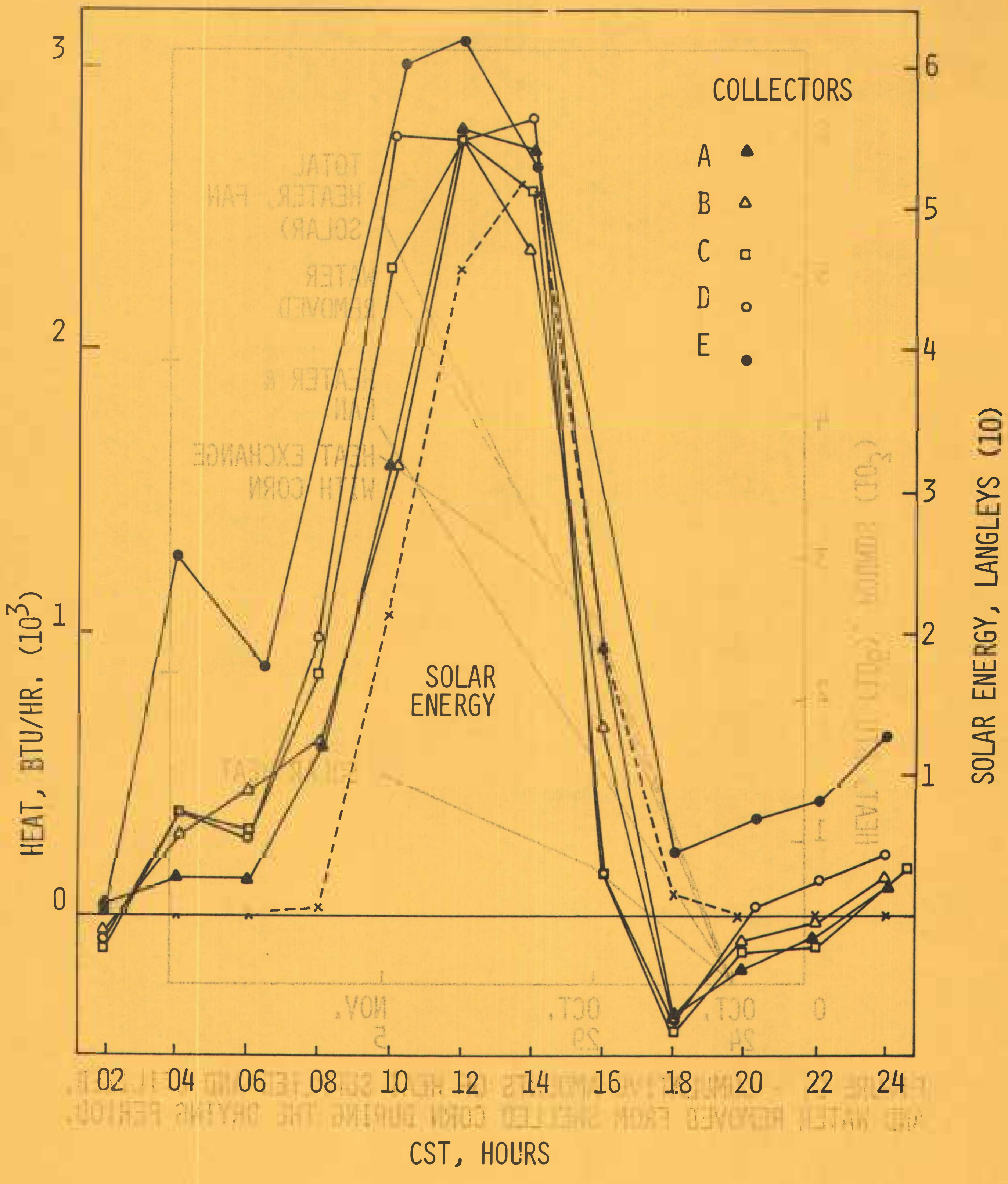

FIGURE 3. COMPARISON OF AVERAGE HEAT INPUT PER HOUR FROM DIFFERENT SOLAR HEAT COLLECTORS, AND SOLAR ENERGY RECORDED.